

This package contains a section of the

# **CE SERVICE HANDBOOK FOR 79XX SERIES DISC DRIVES**

and consists of the following document:

## **7906A/B/D DISC DRIVE**

**Part no. 07906-90905**

(With Appendix A for "H" Model Drives)

Insert this section into the handbook binder P/N 9282-0683 along with cover and tabset P/N 5957-4228

### **NOTE**

The tabset consists of model numbers for all DMD disc drives to be documented in the CE Service Handbook. Not all of these sections are available at this printing—refer to periodic announcements in the CSD service publication *Support Update* for part numbers and availability.

This handbook is intended as a reference of most-frequently-used material for the trained HP Customer Engineer. The information is condensed from other manuals related to the product and is not intended as a substitute for these manuals (see Related Manuals, page v).

## PRINTING HISTORY

New editions incorporate all update material since the previous edition. Updating Supplements, which are issued between editions, contain additional and revised information to be incorporated into the manual by the user. The date on the title page changes only when a new edition is published.

First Edition ..... JUL 1984

## NOTICE

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## SAFETY CONSIDERATIONS

### KEEP WITH MANUAL

**GENERAL** - This product and related documentation must be reviewed for familiarization with safety markings and instructions before operation.

#### SAFETY SYMBOLS



Instruction manual symbol: the product will be marked with this symbol when it is necessary for the user to refer to the instruction manual in order to protect the product against damage.



Indicates hazardous voltages.



Indicates earth (ground) terminal.

#### WARNING

The **WARNING** sign denotes a hazard. It calls attention to a procedure, practice, or the like, which, if not correctly performed or adhered to, could result in injury. Do not proceed beyond a **WARNING** sign until the indicated conditions are fully understood and met.

#### CAUTION

The **CAUTION** sign denotes a hazard. It calls attention to an operating procedure, practice, or the like, which, if not correctly performed or adhered to, could result in damage to or destruction of part or all of the product. Do not proceed beyond a **CAUTION** sign until the indicated conditions are fully understood and met.

**SAFETY EARTH GROUND** - This is a safety class I product and is provided with a protective earthing terminal. An uninterruptible safety earth ground must be provided from the main power source to the product input wiring terminals, power cord, or supplied power cord set. Whenever it is likely that the protection has been impaired, the product must be made inoperative and be secured against any unintended operation.

**BEFORE APPLYING POWER** - Verify that the product is configured to match the available main power source per the input power configuration instructions provided in this manual.

If this product is to be energized via an auto-transformer (for voltage reduction) make sure the common terminal is connected to the earth terminal of the main power source.

#### SERVICING

#### WARNING

Any servicing, adjustment, maintenance, or repair of this product must be performed only by service-trained personnel.

Adjustments described in this manual may be performed with power supplied to the product while protective covers are removed. Energy available at many points may, if contacted, result in personal injury.

Capacitors inside this product may still be charged even when disconnected from its power source.

To avoid a fire hazard, only fuses with the required current rating and of the specified type (normal blow, time delay, etc.) are to be used for replacement.

To install or remove a fuse, first disconnect the power cord from the device. Then, using a small screwdriver, turn the fuseholder cap counterclockwise until the cap releases. Install the proper fuse in the cap — either end of the fuse can be installed in the cap. Next, install the fuse and fuseholder cap in the fuseholder by pressing the cap inwards and then turning it clockwise until it locks in place.

## MAINTENANCE PRECAUTIONS

### WARNING

Any servicing, adjustment, maintenance, or repair of this product must be performed only by service-trained personnel. All WARNING and CAUTION statements in the source documents apply equally to this condensed document.

To avoid dangerous electrical shock, do not operate the disc drive directly from an ac power outlet. AC power for the drive must be obtained from the power panel assembly associated with the drive.

Read the WARNING label attached to the power panel assembly before checking or replacing the primary power fuse.

Hazardous voltages are present within the mainframe whenever ac power is applied. Capacitors may still be charged although power is disconnected. Use extreme caution when working on the disc drive with covers removed.

Do not remove or install PCA's, extender's, or cables with power applied.

"R" Models - the weight of the drive requires two or more persons to safely install it in the rackmount. Before mounting, extend the front legs to prevent tipping of the cabinet. Do not extend more than one module on its rack slides at a time.

Air shipment requires conformance to DOT Regulations, Title 49, parts 171-177 (Hazardous Magnetic Materials).

### CAUTION

Do not remove drive covers when the environment is obviously not clean. Do not run the drive without an absolute filter. Do not run the drive for an extended period without a prefilter.

Do not manually extend the carriage as this causes the heads to mechanically load.

Use only the cleaning materials specified; failure to comply can result in loss of factory warranty.

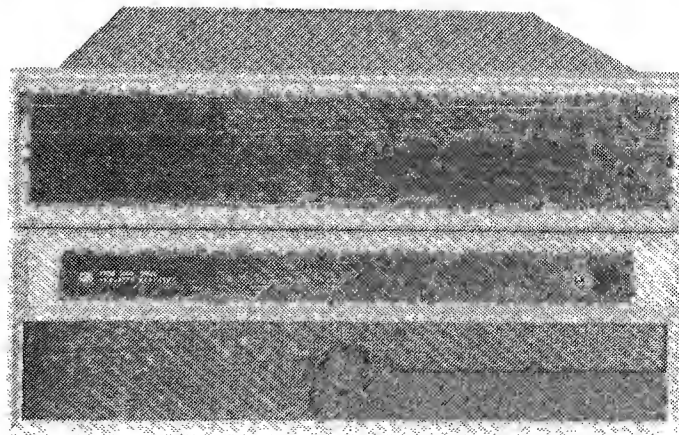
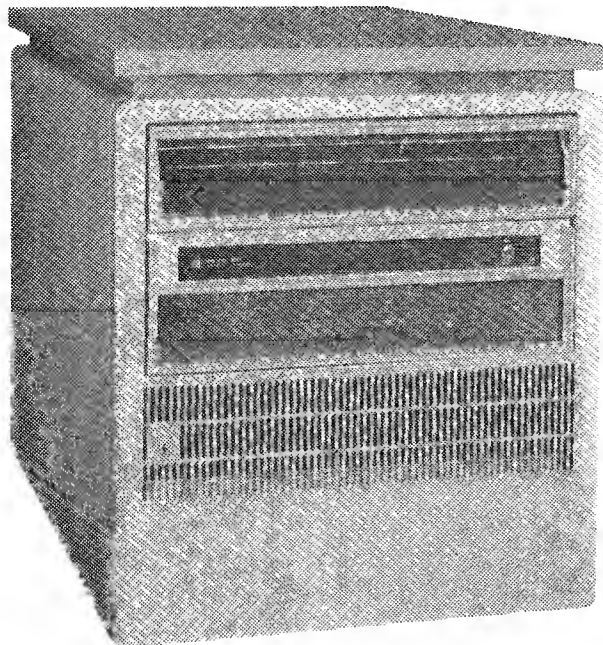
Excessive pressure on the gimbal area of a head can alter the flying attitude, as can contact with an inspection mirror. Use care when cleaning heads.

Do not oil the carriage rails or bearings, and do not allow alcohol to seep into the bearing lubrication pack.

When cleaning the spindle, be sure to remove all masking tape applied.

Ensure that the DSU is disconnected from the drive before 1) checking or adjusting power supply voltages, and 2) before verifying operation of the temperature compensation circuit.

The head alignment PCA must be installed whenever a CE head alignment or servo reference cartridge is to be used.



## RELATED MANUALS

<u>P/N "D" Mod.</u>	<u>P/N A/B Mod.</u>	<u>Title</u>
07906-90911	07906-90901	7906 User's
07906-90912	07906-90902	7906 Installation
07906-90913	07906-90903	7906 Service
07906-90904	07906-90904	7906 Tech Info Package (TIP)
12904-90003	12904-90003	12904 Rack Slides Instl.
19510-90911	n/a	19510D Rack Slides Instl.*
29425-90911	29425-90001	29425 Cabinet Instl & Serv.
40019-90911	40019-90901	40019 Prefilter Instl & Serv.

\* For Option 025 "D" Model only.

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# PRODUCT INFORMATION

SECTION

I

## 1-1. PRODUCT DESCRIPTION

The HP 7906 Disc Drive is a 20-megabyte, random-access, mass-storage device with one fixed disc and one removable disc (cartridge).

A fault detection system consisting of four LED's can indicate nine different drive faults to accelerate troubleshooting.

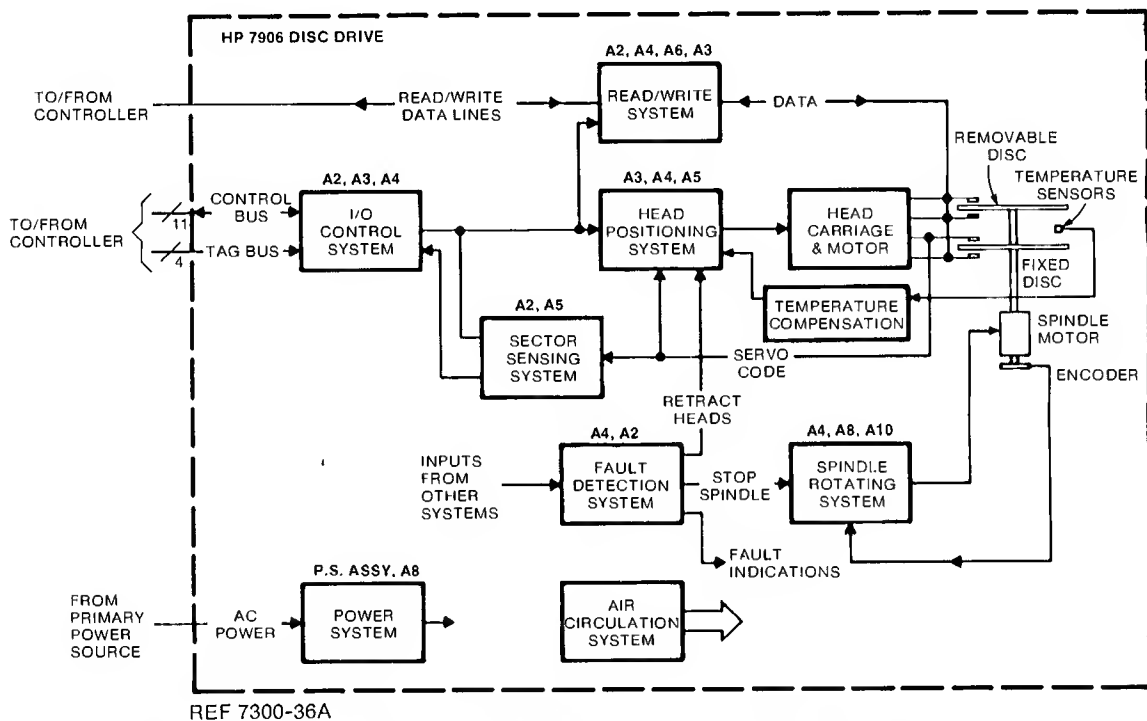


Figure 1 - 1. Basic Block Diagram (with PCA's listed above blocks)

**NOTE:** This portion of the handbook describes 7906 "A", "B", and "D" Model drives. Refer to the blue appendix pages for "H" Model. Differences between models are presented in table 1 - 1.

Table 1-1. Product Descriptions

MODEL	OPT.	DESCRIPTION
7906A		Original drive shipped 1978-1979.
7906B		Redesigned power supply and cabling to meet European regulations - 1979.
7906D		Added shielding for domestic RFI requirements - 1983.
7906H		Current-model drive (i.e., "D") with integrated controller.
	015	Specifies 230V/50Hz operation.
7906HR		Same as "H" model except designed for rack mounting.
	015	Specifies 230V/50Hz operation.
	020	Substitute 28-in. rack slides for std 30-in.
	025	Substitute rack slide kit for 29431F cabinet slides.
7906M		Master drive (includes 13037 Disc Controller).
	015	Specifies 230V/50Hz operation.
	102	Add HP-IB adapter kit.
7906MR		Rack-mountable version of 7906M; options 015, 020, 025*, and 102 also apply.
7906S		Slave drive (controller not included).
	015	Specifies 230V/50Hz operation.
7906SR		Same as "S" model except designed for rack mounting; options 015, 020, 025 also apply.
* Also substitutes 8-foot cable for standard 12-foot multi-unit cable.		

## 1-2. OPTIONS & ACCESSORIES

Table 1-2. Options & Accessories

PRODUCT	OPT.	ACCESSORY TO CURRENT "D" MODEL
13013D		Multi-unit cable (ref table 2-1 for lengths)
13213D		Data cable (ref table 2-1 for lengths)
13175D		HP 1000 CPU I/F cable (ref table 2-1)
13178D		HP 1000 multi-CPU cable (ref table 2-1)
29425D		Low profile cabinet for "M", "S", & "H"
19510D		Rack slide kit for 29431F cabinet, meets new RFI requirements
12904A	001	Rack slides for 29402C cabinet (non-RFI). Substitute 28-in. rack slides for 30-in.
40019D	025	Prefilter for 29425D cabinet Prefilter for 29431F cabinet
13037U		13037 Disc Controller (included with "H" models)
	015	230V, 50 Hz operation
	025	Substitute mounting rails for 29431F cab.
	050	Add HP-IB extender
	102	Add 12745D HP-IB adapter kit
12940A		10 Mb removable disc cartridge
19903A		7906 spare parts kit
	035	Add spares for "H" model
	036	Spares for "H" model only
19904A		7906 alignment tools kit
	035	Add tools for "H" model
13359C		Servo reformatting kit

## 1-3. SERVICE KITS

The customer service kit comprises the last three items in table 1-2 above, i.e., HP 19903A, 19904A, & 13359C.

CE service kit part numbers are 07906-67825 (servo formatting tools), 07906-67850 (alignment tools), and 07906-67801 (empty case for spare parts).

Lists of standard and special service tools are listed in paragraph 2-11.

## 1-4. OPERATING SPECIFICATIONS

For operating specs and characteristics, refer to the appropriate User's Manual and the Technical Data sheet.

For physical and environmental specs, refer to paragraph 2-1.

## **2-1. ENVIRONMENTAL REQUIREMENTS**

All drives must meet the environmental requirements for the host system. The following environmental requirements are considered minimum for all drives.

### **ENVIRONMENTAL REQUIREMENTS**

INLET AIR TEMPERATURE: ..... 10° C TO 40° C (50° F TO 104° F)  
TEMP. RATE OF CHANGE: ..... less than 20° C per hour (36° F/hour)  
RELATIVE HUMIDITY: ..... 8 to 80% with max wet bulb not to exceed  
25.6° C (78° F), noncondensing  
ALTITUDE: ..... sea level to 4,572 m (1500 feet)  
TILT: ..... +/- 20° about either horizontal axis  
SHOCK (11 ms, 0.5 sine): ..... less than 7 g's  
VIBRATION (random profile): ..... less than 0.88 g rms  
ACOUSTIC EMISSION (7906M random seek): ..... less than 60 dbA  
AC POWER: ..... single phase 100,120,220,240 VAC +5,-10 %  
frequency range 47.5 to 66 Hz

### **ELECTROMAGNETIC SUSCEPTIBILITY**

RADIATED: ..... greater than 0.5 V/M, 30 kHz to 1 GHz  
CONDUCTED: ..... greater than 3V rms, 30 Hz to 50 KHz  
ELECTROSTATIC DISCHARGE: ..... greater than 12.5 kV  
MAGNETIC: ..... greater than 5 gauss  
MAGNETIC (disc cartridge): ..... greater than 50 oersteds

### **RACKMOUNTING REQUIREMENTS ("R" Model Drives)**

HEIGHT: ..... 26.52 cm (10.44 in.)  
WIDTH (ahead of mounting flange): ..... 48.03 cm (18.91 in.)  
WIDTH (behind mounting flange): ..... 44.15 cm (17.38 in.)  
DEPTH (from mounting flange): ..... 68.10 cm (26.81 in.)  
DEPTH (overall): ..... 71.12 cm (28.00 in.)  
WEIGHT (approx.): ..... 73.55 kg (162 lb.)  
CENTER OF GRAVITY: ..... 12.95 cm (5.1 in.) up from bottom  
40.13 cm (15.8 in.) from front  
20.06 cm (7.9 in.) from left  
PREFILTER DUCT (29400B or 29402C cabinet): ..... 13.3 cm (5.25 in.)  
PREFILTER DUCT (29425D or 29431F cabinet): ..... 8.9 cm (3.5 in.)

## **2-2. INSTALLATION**

For installation details refer to the following manuals:

### **Series "A", "B", & "H" Drives**

- HP 7906 DISC DRIVE INSTALLATION, P/N 07906-90902
- HP 7906 DISC DRIVE SERVICE MANUAL, P/N 07906-90903
- HP 40019 PREFILTER INSTALLATION & SERVICE, P/N 40019-90901
- HP 29425 CABINET INSTALLATION & SERVICE, P/N 29425-90001
- HP 12904 SLIDE MOUNTING KITS INSTALLATION, P/N 12904-90003

### **Series "D" & "H" Drives**

- HP 7906D DISC DRIVE INSTALLATION, P/N 07906-90912
- HP 7906D DISC DRIVE SERVICE MANUAL, P/N 07906-90913
- HP 40019D PREFILTER INSTALLATION & SERVICE, P/N 40019-90911
- HP 29425D CABINET INSTALLATION & SERVICE, P/N 29425-90911
- HP 19510D SLIDE MOUNTING KIT INSTALLATION, P/N 19510-90911

## **INSTALLATION SUMMARY**

1. **AC POWER SOURCE CHECK -**  
verify incoming power (refer to paragraph 2.1)
2. **AC POWER CORD CHECK -**  
verify correct power cord (refer to table 9-1)
3. **FUSE CHECK -**  
verify correct primary/secondary fuses (refer to tables 2-2 & 2-3)
4. **INTERCONNECTIONS -**  
verify cables are routed and anchored properly (see figures 9-3,4,5)
5. **VISUAL INSPECTION -**  
check cable termination and logical unit addresses
6. **ABSOLUTE FILTER AIR PRESSURE -**  
must be greater than 0.35 inches of water
7. **INSPECT HEADS -**  
clean if necessary
8. **+5 VOLT CHECK -**  
check +5V testpoint on A5 track follower for +4.95 to +5.05
9. **TEMPERATURE COMPENSATION CHECK -**  
refer to paragraph 2-1. PM Summary (or service manual section III)
10. **SEEK TIME CHECK -**  
alternate seeks from cylinder 0 to 410 = 42 to 45 msec
11. **RADIAL ALIGNMENT CHECK -**  
refer to paragraph 2-10. PM Summary (or service manual section III)
12. **INDEX TRANSDUCER CHECK -**  
refer to paragraph 2-10. PM Summary (or service manual section III)
13. **HEAD ALIGNMENT CHECK -**  
must be within 6 units of value on cartridge label
14. **A2 MICROPROCESSOR CHECK ("H" DRIVES ONLY) -**  
verify proper jumper configuration (refer to Appendix A)
15. **SELF TEST VERIFICATION ("H" DRIVES ONLY) -**  
verify proper completion
16. **SYSTEM CHECKOUT -**  
verify operational integrity via on-line/off-line utilities.

## 2-3. CABLE CONNECTIONS

For cable hookup, see interconnection foldout figures 9-3, 9-4, 9-5.

For cable options, refer to table 2-1. ("D" drives must have cables selected from the right column only.)

Table 2-1. Cable Options

MULTI UNIT CABLES - 13013B/D			
LENGTH*	13013B	OPTION	13013D
6	13013-60011	001	13013-60024
8	13013-60012	003	13013-60025
12	13013-60013	STD	13013-60027
18	13013-60014	002	13013-60028
40	13013-60017	H01	13013-60031
50	13013-60018	H02	13013-60032
25	13013-60019	H03	13013-60029
30	13013-60020	H04	13013-60030
9	13013-60021	H05	13013-60026
60	13013-60022	H09	13013-60033
70	13013-60023	H10	13013-60034
MULTI CPU CABLE & PCA - 13178C/D			
LENGTH*	13178C	OPTION	13178D
8	13178-60003	STD	13178-60007
16	13178-60004	001	13178-60008
50	13178-60005	H04	13178-60010
25	13178-60006	H05	13178-60009
INTERFACE CABLE & PCA - 13175B/D			
LENGTH*	13175B	OPTION	13175D
18	13037-60030	STD	13037-60043
30	13037-60037	H02	13037-60044
50	13037-60036	H05	13037-60045
65	13037-60039	H08	13037-60046
6	13037-60029	025#	13037-60047
DATA CABLES - 13213B/D			
LENGTH*	13213B	OPTION	13213D
6	13213-60006	004	13213-60011
10	13213-60007	STD	13213-60012
25	13213-60008	001	13213-60013
50	13213-60009	002	13213-60014
75	13213-60010	003	13213-60015
*In feet	#Included with 13178C/D STD		

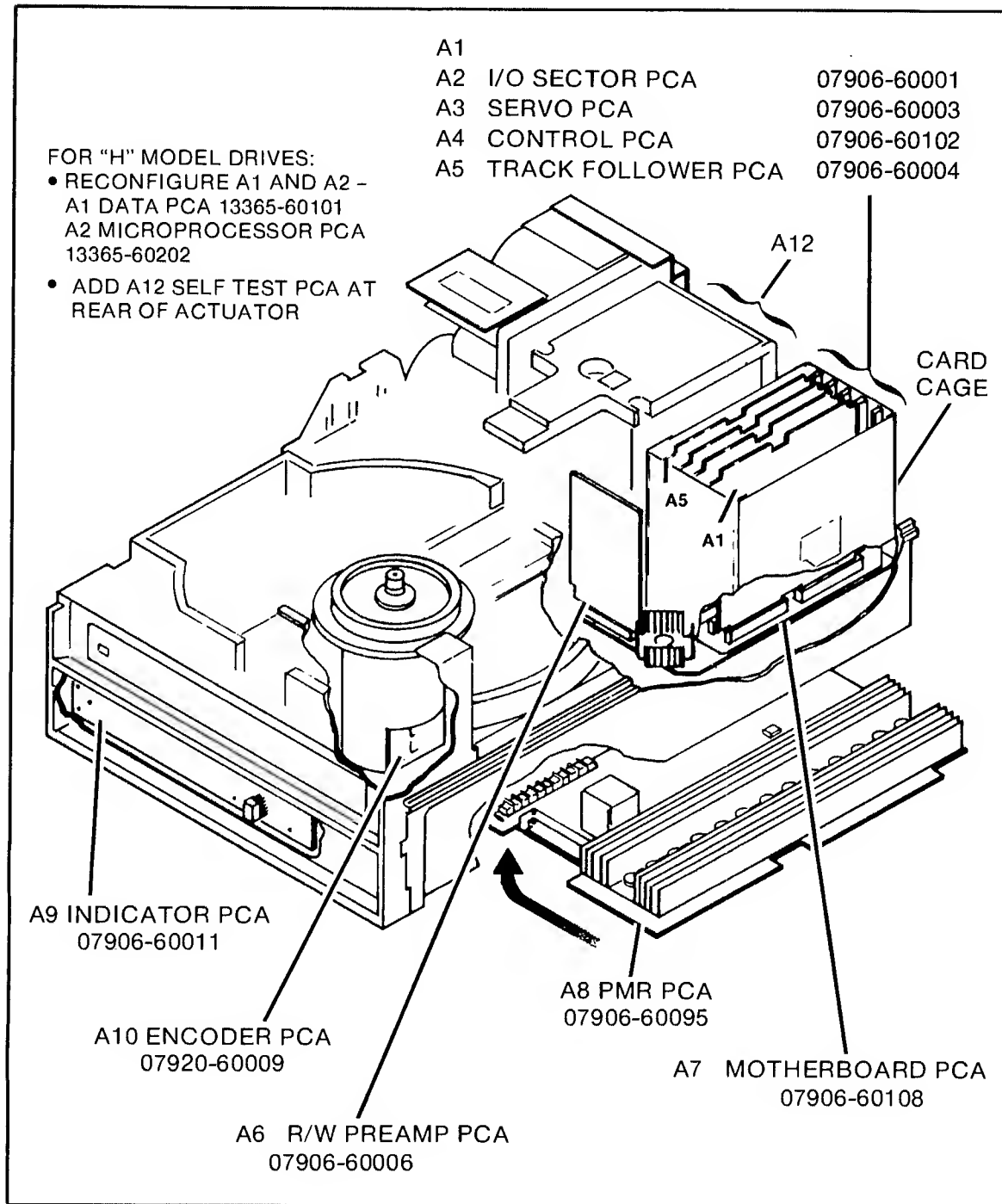


## 2-4. PCA LOCATION/CONFIGURATION

See figure 2-1 below for PCA location; note "H" model distinctions.

For PCA functions, see figure 1-1 and refer to paragraph 4-3.

For PCA compatibility, refer to table 3-1.



CE 7906-01

Figure 2-1. PCA Locations & Part Numbers

## 2-5. CONTROLS & INDICATORS

To interpret front panel lights and LED's (behind access door) refer to table 4-1. To interpret "H" model LED's, refer to test failure table in Appendix A.

### OPERATOR PANEL

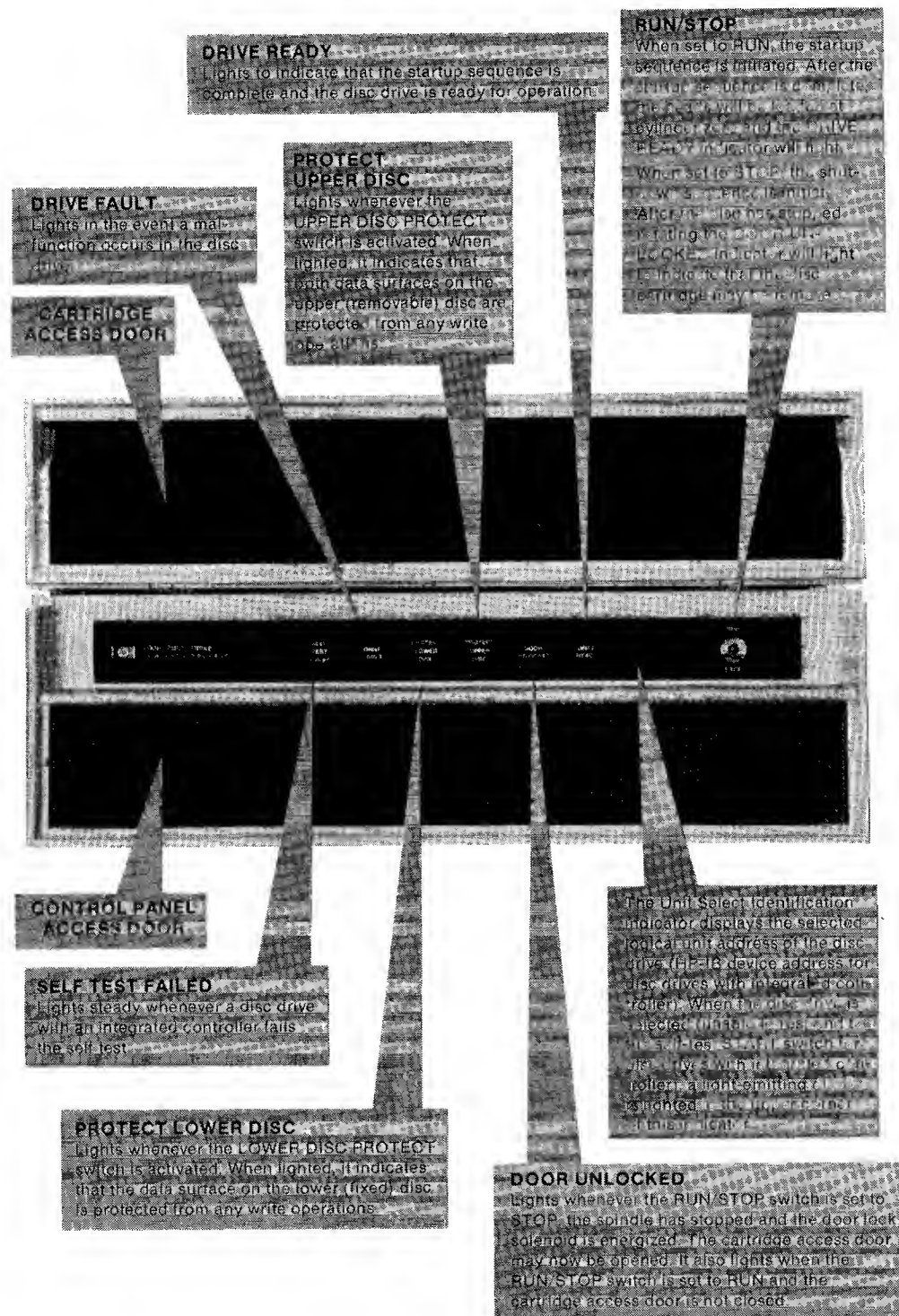


Figure 2-2. Operator Panel

## CONTROL PANEL

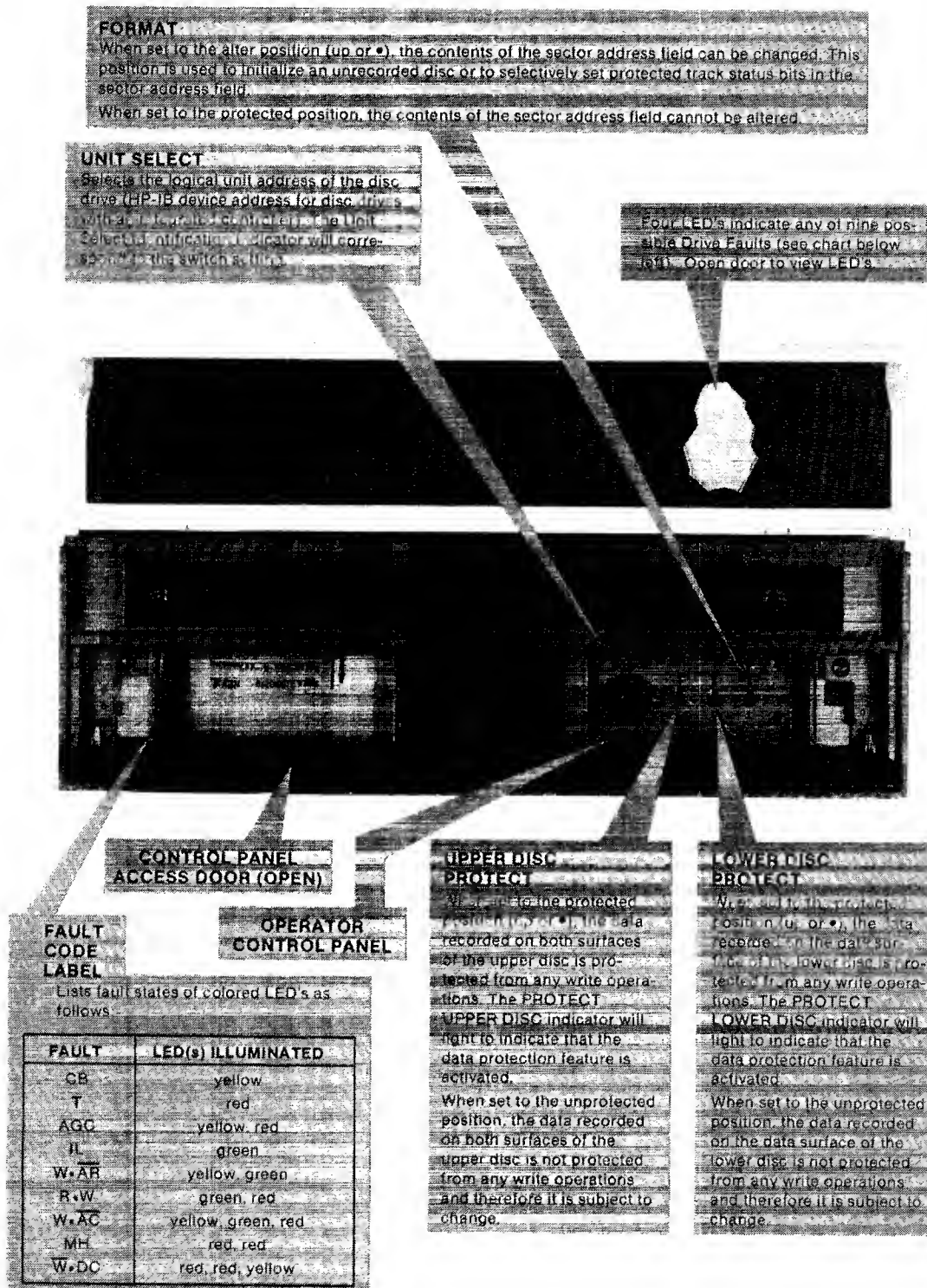


Figure 2-3. Control Panel

## REAR PANEL

### WARNING

To install or remove a fuse, first disconnect the power cord from the device. Then, using a small screwdriver, turn the fuseholder cap counterclockwise until the cap releases. Install the proper fuse in the cap — either end of the fuse can be installed in the cap. Next, install the fuse and fuseholder cap in the fuseholder by pressing the cap inward and then turning it clockwise until it locks in place.

F2

This 8-ampere, 250-volt, slo-blo secondary fuse (part no. 2110-0383) provides overload protection for the  $\pm 36$  Vdc power supply.

F3

This 5-ampere, 250-volt, slo-blo secondary fuse (part no. 2110-0383) provides overload protection for the  $\pm 10$  Vdc power supply.

F4

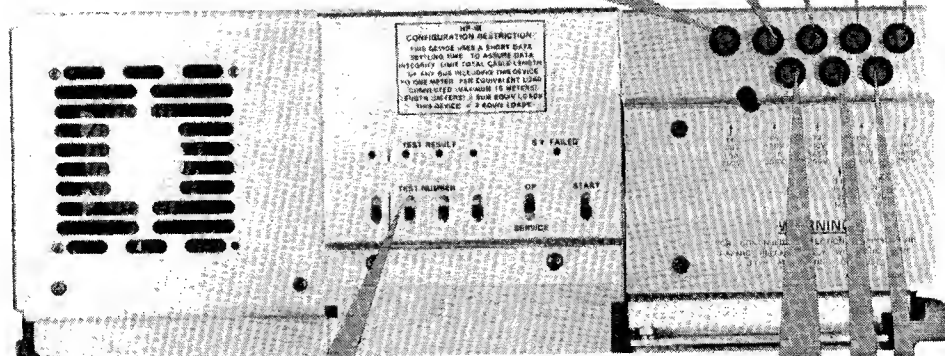
This 4-ampere, 250-volt secondary fuse (part no. 2110-0043) provides overload protection for the  $\pm 10$  Vdc unregulated ( $\pm 12$  Vdc regulated) power supply.

F5

This 1.5-ampere, 250-volt secondary fuse (part no. 2110-0043) provides overload protection for the  $\pm 20$  Vdc unregulated ( $\pm 12$  Vdc regulated) power supply.

F6

This 1.5-ampere, 250-volt secondary fuse (part no. 2110-0043) provides overload protection for the  $\pm 20$  Vdc unregulated ( $\pm 12$  Vdc regulated) power supply.



Note: A secondary fuse is also located on PCA-A8 (A8F1), P/N 2110-0099, 1A, 125V.

F9

This 20-ampere, 125-volt secondary fuse (part no. 2110-0098) provides initial overload protection for the  $\pm 20$  Vdc unregulated ( $\pm 12$  Vdc regulated) and  $\pm 20$  Vdc unregulated ( $\pm 12$  Vdc regulated) power supplies.

F8

This 20-ampere, 125-volt secondary fuse (part no. 2110-0098) provides initial overload protection for the  $\pm 10$  Vdc unregulated ( $\pm 5$  Vdc regulated) power supply.

F7

This 20-ampere, 125-volt secondary fuse (part no. 2110-0098) provides initial overload protection for the  $\pm 36$  Vdc and  $\pm 36$  Vdc power supplies.

### SELF-TEST PANEL AND FAN

Only on disc drives with an integrated controller. A servicing aid for troubleshooting the integrated controller and disc drive. Automatically performs a self-test routine whenever power is turned on. To perform the self-test, push the RUN/STOP switch. To exit the self-test, push the STOP/RESET switch.

Note: For "H" model drives, see appendix, figure A-5.

Figure 2-4. Rear Panel

## 2-6. AC POWER: CORDS/FUSES/STRAPPING

2-7. POWER CORD OPTIONS. See figure 9-1 in diagrams section IX for available power cords.

2-8. RESTRAPPING AC. See figure 9-2 in diagrams section IX for restrapping input power.

2-9. FUSES. For fuse locations, see previous figure 2-4. For fuse part numbers, refer to tables 2-2 & 2-3 below.

**Table 2-2. Primary Power Fuse Ratings**

SOURCE VOLTAGE	REQUIRED RATING	HP PART NO.
100 Vac	8AT*, 250V	2110-0383
120 Vac	8AT*, 250V	2110-0383
220 Vac	4AT*, 250V	2110-0365
240 Vac	4AT*, 250V	2110-0365
* The T indicates that a time delay or slo-blo fuse must be used.		

**Table 2-3. Secondary Fuse Ratings**

FUSE	REQUIRED RATING	HP PART NO.	SUPPLY VOLTAGE
F2	8A, 250V, SB*	2110-0383	-36 VDC
F3	8A, 250V, SB*	2110-0383	+36 VDC
F4	8A, 250V, SB*	2110-0383	+10 VDC
F5	1.5A, 250V, FB*	2110-0043	+20 VDC
F6	1.5A, 250V, FB*	2110-0043	-20 VDC
F7	20A, 125V, MB*	2110-0098	26 VAC
F8	20A, 125V, MB*	2110-0098	9 VAC
F9	20A, 125V, MB*	2110-0098	17 VAC
A8F1	1A, 125V, FB*	2110-0099	+25 VAC
*SB, MB, and FB indicate slow-blo, medium-blo, and fast-blo, respectively. The correct fuses must be used as specified.			

## **2-10. PREVENTIVE MAINTENANCE**

PM for the HP 7906 is scheduled for 6-month intervals in a clean environment, more often if operating environment is considered severe.

Perform PM steps in the order listed below; refer to section II of the service manual for details.

Refer to next paragraph for recommended tools.

### **PM SUMMARY**

#### **1. Prefilter & Impeller**

Remove duct and prefilter. Clean inside of duct with Texwipe or vacuum cleaner. Remove compacted dirt from impeller vanes. Replace prefilter if necessary.

#### **2. Absolute Filter Air Pressure**

Must be greater than 0.35 inches of water, 50 and 60 Hz.

#### **3. Cleaning Heads**

Inspect heads, clean if necessary using ONLY 91% isopropyl alcohol and head cleaning sleeves followed by a clean dry sleeve. Inspect for damage or particulate when completed.

#### **4. Cleaning Rails**

Clean rails using ONLY 91% isopropyl alcohol and Q-tips followed by a clean dry Q-tip.

#### **5. Cleaning Spindle Assembly**

Remove magnetic particles from hub with masking tape. Clean hub and cone using ONLY 91% isopropyl alcohol and a Texwipe followed by a clean dry wipe.

#### **7. Cleaning Main Casting & Receiver**

Remove particles with masking tape or vacuum cleaner. Clean ONLY with 91% isopropyl alcohol and a Texwipe followed by a clean dry wipe.

#### **8. Power Supply Adjustment**

Using a digital voltmeter monitor +5V testpoint on A5 Track Follower. Adjust potentiometer on A8 PMR for +4.95 to +5.05 volts (see figure 6-1).

## PM SUMMARY (Cont'd)

### 9. Temperature Compensation Check

#### A. TEMPERATURE SENSOR CABLE ASSEMBLY

Measure Between Pins	Resistance
1 and 5	short
2 and 5*	10k to 500k ohms
3 and 5*	10k to 500k ohms

\*Readings must be within 20% of each other.

#### B. PCA-A5 TRACK FOLLOWER CONNECTOR

1. Test plug side A on PCA-A5J1
2. Voltmeter on delta T testpoint
3. -3.95 to -4.35 Vdc: before DRIVE READY
4. Voltmeter on -P testpoint
5. -1.95 to -2.20 Vdc: after heads load, before DRIVE READY
6. -1.55 to -1.75 Vdc: 2 minutes after DRIVE READY
7. Set STOP switch
8. Test plug side B on PCA-A5J1: set RUN switch
9. Voltmeter on +P testpoint
10. +1.95 to +2.20 Vdc: after heads load
11. 30 seconds after heads load, remove plug, note DRIVE READY.

### 10. Mainframe Switches & Solenoids

Inspect for damage or loose wires: carriage latch solenoid, cartridge -in - place switch, door lock solenoid, door closed and door locked switches.

#### 11. Seek Time Adjustment:

Alternate seeks, cylinder 0 to 410, 42 to 45 msec. Adjust R92 on A3 Servo board.

#### 12. Radial Alignment

Head 1 functions 4 & 6. Corrected values calculated from cartridge label must not differ by more than 1.0.

#### 13. Index Transducer Alignment

Function 5, heads 0 & 1. Corrected values from cartridge label within 2 of 0 and sum to 0 +/- .4.

#### 14. Head Alignment

20-minute random seek, 50-msec delay. Heads 0 & 1, function 7. Meter reading within 6 units of calibration label values on cartridge.

#### 15. "H" Drive Only

Turn power OFF; if spindown time of card cage fan less than 12 seconds, replace.

## 2-11. SERVICE TOOLS & SUPPLIES

### STANDARD TOOLS

<b>CAUTION</b>
----------------

Filtered isopropyl alcohol is a restricted article (flammable liquid).  
Transport in accordance with Department of Transportation  
regulations for hazardous materials.

Alcohol, Isopropyl, filtered*	HP 8500-0559
Bit, 1/4-inch drive, hex key (for use with torque wrench, part no. 8710-1007)	HP 8710-0664
Bit, 1/4-inch drive, Pozidriv, #2	HP 8710-0903
Bit, 1/4-inch drive, slotted drive	HP 8710-0669
Bit, 1/4-inch drive, 9/64 Hex	HP 8710-1241
Bit, 1/2-inch, Extended Hex (for 1535-2653)	HP 8710-1223
Cleaning Sleeves (including cleaning handle)*	HP 9310-5074
Cleaning Wipes*	HP 9310-4865
Face Mask	HP 9301-0170
Finger Cot	HP 9300-0399
Inspection Mirror	HP 8830-0005
Kimwipe Tissues	HP 9300-0001
Pin Extractor	HP 8710-0688
Pliers, Diagonal Cutting	HP 8710-0006
Pliers, Long Nose	HP 8710-1094
Q-tips	HP 8520-0023
Screwdriver, 4 x 1/4-inch	HP 8730-0001
Screwdriver, 4 x 1/8-inch	HP 8730-0008
Screwdriver, Pozidriv	HP 8710-0899
Screwdriver, Pozidriv	HP 8710-0900
Steel Rule, 6-inch	HP 8750-0335
Tape, Masking	HP 0460-0030
Wire Strippers	HP 8710-0647
Wrench, Box, 7/16-inch	HP 8720-0017
Wrench, Torque, 0 to 12 inch-pounds	HP 1535-2653
Wrench, Torque, Variable, 80 inch-pounds	HP 8710-1007

\*Do not substitute



## SPECIAL TOOLS

Actuator Assembly Radial Alignment Tool	12995-20022
Air Pressure Measuring Guage	0101-0374
Air Pressure Probe Assembly	12995-60013
CE Head Alignment Cartridge	12995-60030
CE Servo Reference Cartridge	12995-60031
Dial Indicator	8750-0308
Dial Indicator Holder	12995-20017
Extender PCA	12995-60029
Extension Cable, Servo Head	12995-60038
Formatted Disc Cartridge	12940A
Hand Degausser	0950-1551
Head Initial Position Tool	12995-60012
Head Installation Tool	12995-60008
Head Alignment Tool	12995-60007
Index Transducer Alignment Tool	12995-60051
Index Transducer Alignment Hub	12995-60005
Run/Stop Adapter Tool	07906-60082
Servo Formatting PCA	12995-60114
Torque Wrench, Initial Head, 3 inch-pounds	8710-0665
Torque Wrench, Final Head, 5 inch-pounds	8710-0666
Temperature Compensation Test Fixture	07906-60012
 DSU (Disc Service Unit)	 13354-60011
Head Alignment PCA	12995-60040
DSU Adapter	12995-60048
DSU Test Module	13354-60005
Head Alignment PCA	13354-60010
50-pin Jumper Cable	13354-60012
20-pin Jumper Cable	13354-60013
I/O Sector PCA (for "H" drives only)	07906-60001
50-pin Connectors (Intern to DSU)      (2)	12995-60010

# CONFIGURATION

SECTION

III

This section contains information pertaining to all "MAC family" drives.

## 3-1. SYSTEM CONFIGURATION

For information on how MAC family drives are configured in various systems, refer to the Peripheral Configuration Guide, P/N 5953-9450, available from Corporate Literature Distribution Center, COMSYS 0070.

For model differences within the HP 7906, refer to tables 1-1 & 1-2.

For configuration of single drives, see interconnect diagrams in section IX.

## 3-2. ABSOLUTE FILTER REQUIREMENTS - MAC FAMILY

Note the different filter part numbers and pressure specifications for absolute filters on MAC family drives:

<u>MODEL</u>	<u>FILTER P/N</u>	<u>MINIMUM AIR PRESSURE</u>
All 7905's	3150-0276	0.35
All 7906's	3150-0276	0.35
7920's with contam. shield	3150-0340	0.45
7920's w/o contam. shield	3150-0276	0.60
All 7925's	3150-0340	0.30

The two filter types are mechanically interchangeable but functionally different. The filtration ability is the same but the air volume and venturi point is different. These differences are necessary due to variations in the design of the disc chamber, the contamination shield, or lack of one, and the air pump action created by the varying number of spinning discs.

## 3-3. FIRST SERIAL NUMBERS

The first serial prefix for each model is listed below. "A" model prefixes are not listed since they are all prior to "B" models.

<u>DRIVE</u>	<u>B</u>	<u>C</u>	<u>D</u>
7906	1915A	none	2332A
7920	1916A	none	2332A
7925	1916A	none	2332A
13037	1630A	1915A	2332A

### 3-3. 7905/7906 PCA COMPATIBILITY

Table 3-1. PCA Compatibility - 7905 vs. 7906

PCA	7905A	7906A, 7906B/H
A 2 I/O Sector	07905-6X001 or 07906-6X001	07906-6X001
A 3 Servo	07905-6X003 or 07906-6X003	07906-6X003
A 4 Control	07905-6X002 or 07906-6X002 or 07906-6X102 *1	07906-6X002 or 07906-6X102 *1
A 5 Track Follower	07905-6X004 or 07906-6X004	07906-6X004
A 6 Preamp	07905-6X006 or 07906-6X006	07906-6X006
A 7 Motherboard	07905-60008	07906-60008 *2 07906-60042 *2 07906-60108
A 8 Power & Motor Regulator	07905-6X005 or 07905-60007	07906-6X005 or 07906-6X095
A 10 Spindle Encoder	07905-60009 or 07920-60009 *3	07920-60009
Actuator Assembly	07905-6X030	07905-6X030
Spindle Motor	07905-6X021	07906-6X021
A 1 "H" Drive Data	N/A	13365-6X001 *4 13365-6X101
A 2 "H" Drive Microprocessor	N/A	13365-6X002 *5 13365-6X102 *5 13365-6X202
*1 disables brush motor *2 use only 07906-60108 for field replacement *3 requires two nylon washers (2190-0338) if used with 07905-60021 spindle see service note 7905A-21 *4 use only 13365-6X101 for field replacement - see service note 7906H-07 *5 use only 13365-6X202 for field replacement		

# TROUBLESHOOTING

## SECTION

## IV

### 4-1. POWER SUPPLY VOLTAGES

See figure 6-1 to verify secondary voltages on PMR board (PCA-A8).

### 4-2. FAULT INDICATORS

Table 4-1 decodes the front panel fault indicators and LED's.

Table 4-1. Status Lights & LED's

INDICATOR/ INDICATION	CIRCUIT DESCRIPTION	FUNCTIONAL SYSTEM*
Unit Select Identification Indicator	Indicator is lit when both of the following conditions are met: a. Control bus bits C0 through C2 match signals US0 through US2 from UNIT SELECT switch S3. b. Unit Select flip-flop set. [ADU (Address Unit) signal selected on tag bus while STROBE signal is active sets flip-flop.]	I/O Control System A2 I/O Sector A4 Control A9 Indicator
PROTECT UPPER/LOWER DISC indicator	Indicator is lit when UPPER PROTECT/LOWER PROTECT switch is set to DISC PROTECT.	Read/Write System A9 Indicator A2 I/O Sector
DOOR UNLOCKED indicator	Indicator is lit when all of the following conditions are met (door lock solenoid energized): a. RUN/STOP switch set to STOP. b. Carriage fully retracted. c. Spindle stopped.	Spindle Rotating System A9 Indicator A4 Control A8 PMR
DRIVE READY indicator	Indicator is lit when all of the following conditions are met: a. AGC (Automatic Gain Control) signal active. b. SB (Servo Balanced) signal active. c. TTO (Temperature Timeout) signal active.	Head Positioning System A3 Servo A4 Control A5 Track Follower A8 PMR
DRIVE FAULT indicator	Indicator is lit when any one of the following nine drive faults occur: TO Timeout ILF Interlock Fault W·AR Write AND no Access Ready AGCF AGC Fault R·W Read AND Write together CBF Carriage Back Fault W·AC Write AND no ACW signal W·DC No Write AND DCW present MH Multiple Heads selected	Fault Detection System A4 Control A6 Preamp See breakdown following
*Suspect PCA's are listed in order of probability; non-PCA causes are not listed.		

**Table 4 – 1. Status Lights & LED's (cont'd)**

INDICATOR/ INDICATION	CIRCUIT DESCRIPTION	FUNCTIONAL SYSTEM*
IL drive fault indication (green LED)	LED is lit when any one of the following conditions is met: a. 25 Vac, +36 Vdc, +12 Vdc, +5 Vdc, -12 Vdc, -24 Vdc or -36 Vdc power source below tolerance or missing (fuse blown). b. PCA-A2, A3, A4, A5, or A6 improperly seated. c. PCA-A8 or A10 has improper wiring connection. d. Track formatter PCA and PCA-A2 both present in drive. e. Temperature switch on PCA-A8 is open.	Fault Detection System. Routed through all PCA's. Circuits on A4 Control.
AGC drive fault indication (yellow, red LED's)	LED's are lit when the AGC signal becomes inactive while the heads are loaded and are not doing a seek home.	Fault Detection System A3 Servo A4 Control A5 Track Follower
CB drive fault indication (yellow LED)	LED is lit when CRB (Carriage Back) and DRDY (Drive Ready) signals active.	Fault Detection System A4 Control
W. $\overline{AR}$ drive fault indication (yellow, green LED's)	LED's are lit when drive is in write mode and ACRY (Access Ready) signal inactive.	Fault Detection System A4 Control A3 Servo A5 Track Follower
R.W drive fault indication (green, red LED's)	LED's are lit when URG (Unselected Read Gate) signal active AND WRITE signal active.	Fault Detection System A2 I/O Sector A4 Control
W. $\overline{AC}$ drive fault indication (yellow, green, red LED's)	LED's are lit when drive is in write mode but no data signal present.	Fault Detection System A4 Control A6 Preamp
MH drive fault indication (red, red LED's)	LED's are lit when more than one head is selected for reading or writing.	Fault Detection System A6 Preamp A4 Control
$\overline{W}$ .DC drive fault indication (red, red, yellow LED's)	LED's are lit when DC current is supplied to head drivers and drive is not in write mode.	Fault Detection System A6 Preamp A4 Control
T drive fault indication (red LED)	LED is lit if the heads are not settled on the addressed cylinder (ACRY signal active) within 90 milliseconds after the SK signal becomes active. LED is also lit if either: a. Carriage has not reached the retracted position [CRB (Carriage Back) signal active] within 1.25 seconds after RET (retrack) signal becomes active. b. Heads are not settled on cylinder 0 within 1.25 seconds after the RET or $\overline{RH}$ signal becomes inactive.	Fault Detection System A3 Servo A4 Control

**Table 4 – 1. Status Lights & LED's (cont'd)**

<b>INDICATOR/ INDICATION</b>	<b>CIRCUIT DESCRIPTION</b>	<b>FUNCTIONAL SYSTEM</b>
Spindle starts to rotate from a stationary state	Spindle rotation occurs when all of the following conditions are met:  a. Cartridge in place and door locked. b. No IL or TO drive fault. c. RUN/STOP switch set to RUN. d. Carriage fully retracted (CRB).	Spindle Rotating System A4 Control A8 PMR A10 Encoder
Spindle continues to rotate	Once started, the spindle continues to rotate as long as carriage is not fully retracted and ILF (Interlock Fault) signal inactive.	Spindle Rotating System A4 Control A8 PMR A10 Encoder
Heads seek to cylinder 0 (home) from the retracted position	During a power-up operation, the heads seek home when the RET (Retract) signal becomes inactive. This occurs when the SPU (Spindle Speed Up) signal becomes active.	Head Positioning System A4 Control A8 PMR A3 Servo A5 Track Follower
Heads seek from one cylinder to another	The heads seek from one cylinder to another provided all of the following conditions are met:  a. Heads are settled on a cylinder [ACRY (Access Ready) signal active]. b. The SK (Seek Command) signal from the controller is present. c. The address to which the heads are to seek is not an illegal one (> 410).	Head Positioning System A4 Control A3 Servo A2 I/O Sector A5 Track Follower

## 4-3. PCA FUNCTIONS

The following list shows the circuits associated with each PCA. For input/output signals and mnemonic definitions, refer to section X.

### A2 I/O SECTOR:

Control bus transceivers  
Tag bus decoders  
Status registers  
Sector counters & compare  
Seek check & 1st status  
Detect logic

### A3 SERVO:

AGC fault logic  
Cylinder counter logic  
Track center detect  
Head load/unload logic  
Velocity amp  
TAC buffer  
Servo logic & amp  
ICA Detector

### A4 CONTROL:

Run spindle logic  
Brush & door lock logic  
Drive ready logic  
Attention logic  
Servo control logic  
Fault & status logic  
Interlock fault detect  
Timeout counter

### A5 TRACK FOLLOWER

Servo code preamp  
Peak detect  
Phase lock loop  
Offset generator  
Head select  
Lower disc index detect  
AGC integrator/comparator  
Position amplifier  
Temperature compensation  
Offset circuits

### A6 R/W PREAMP:

Head select enable  
Read data enable  
Write data enable  
Decrease write current  
AC/DC Write current sense  
Read preamp

### A8 PMR:

3 MHz oscillator  
Speed up/down detect  
Phase comparator  
Motor commutation logic  
Spindle power amps  
Interlock fault logic  
Emergency retract circuit  
Servo enable delay  
Linear motor amp  
Carriage solenoid driver  
Brush motor driver  
Door latch driver  
Sec. voltage regulators

## 4-4. DSU FUNCTIONS

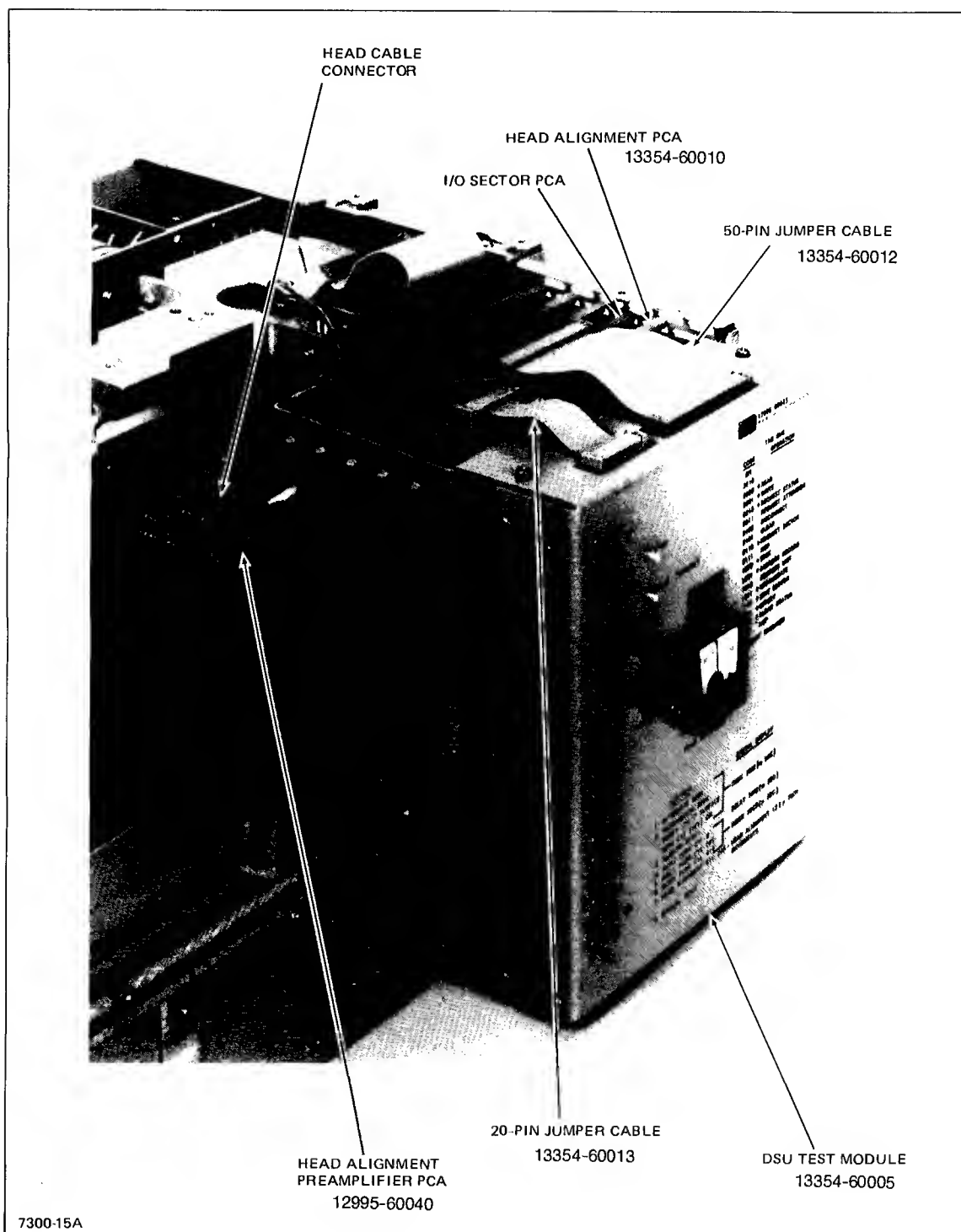


Figure 4-1. DSU Installed



**Table 4 - 2. DSU Functions 1,2,3, & 8**

<b>CONTROL/ INDICATOR</b>	<b>FUNCTION</b>
<b>Function No. 1 — Alternate Seek</b>	
FUNCTION switch	Selects automatic Alternate Seek function (position 1).
START (STROBE) pushbutton	Starts operation of Alternate Seek function. Heads first seek to cylinder 0, then to the cylinder address selected on the upper bank of ten toggle switches, and then alternately between this address and the cylinder address selected on the lower bank of ten toggle switches. If either selected address is an illegal one (greater than 410), the heads seek to the legal address and remain there. If both addresses are illegal, no seek is performed.
STOP pushbutton	Stops operation of Alternate Seek function. Heads seek to cylinder 0 (home) and remain there.
Upper bank of 10 toggle switches (1 thru 512)	Select cylinder address to which heads seek after leaving cylinder 0.
Lower bank of 10 toggle switches (1 thru 512)	Select cylinder address to which heads seek after leaving cylinder address selected by upper bank of 10 toggle switches.
DELAY control	Selects time interval between seeks.
3-digit display	Indicates time interval for seek. Readout is in milliseconds.
<b>Function No. 2 — Incremental Seek</b>	
FUNCTION switch	Selects automatic Incremental Seek function (position 2).
START (STROBE) pushbutton	Starts operation of Incremental Seek function. Heads first seek to cylinder 0 and then to next address. Next address is determined by adding the numbers selected by the lowest nine (1 thru 256) switches on the lower bank of ten toggle switches. Incremental seeking of the heads to the next address continues until a next address greater than 410 is reached. When this occurs, the programmed next address number is subtracted from the preceding valid next address (410 or less), causing decremental seeking to the next address until cylinder 0 is reached. The heads continue this incremental and decremental seek action until the STOP pushbutton is pressed.
STOP pushbutton	Stops operation of Incremental Seek function. Heads seek to cylinder 0 (home) and remain there.
Lower bank of 9 toggle switches (1 thru 256)	Select amount by which current cylinder address is incremented (or decremented) for next seek.
DELAY control	Selects time interval between seeks.
3-digit display	Indicates time for seek. Readout is in milliseconds.
<b>Function No. 3 — Random Seek</b>	
FUNCTION switch	Selects automatic Random Seek function (position 3).
START (STROBE) pushbutton	Starts operation of Random Seek function. Heads first seek to cylinder 0 and then to cylinder addresses generated by the DSU in a pseudo-random sequence.
<b>Function No. 3 — Random Seek (Continued)</b>	
STOP pushbutton	Stops operation of Random Seek function. Heads seek to cylinder 0 (home) and remain there.
DELAY control	Selects time interval between seeks.
3-digit display	Indicates time interval between seeks. Readout is in milliseconds.

**Table 4-2. DSU Functions 1,2,3, & 8 (cont'd)**

CONTROL/ INDICATOR	FUNCTION																		
	<b>Function No. 8 — Manual Mode</b>																		
FUNCTION switch	Selects Manual mode of operation (position 8).																		
START (STROBE) pushbutton	When pressed, activates STROBE signal applied to the tag bus decoder in I/O Control PCA-A2. This executes the command selected by tag bus switches 64 through 512 on the upper bank of 10 toggle switches. The STROBE signal is active as long as the START (STROBE) pushbutton is held down.																		
Upper 4 toggle switches (64 thru 512)	Select input command to be supplied on tag bus to drive. The toggle switch settings and the associated input commands are listed on the upper right-hand corner of the DSU front panel. The DSU does not issue a Write command.																		
T0 thru T3 LED indicators	Indicate the state of the tag bus bits (input command) selected by the upper 4 toggle switches (64 through 512).																		
Lower bank of 16 toggle switches (1 thru 512 and 1 thru 32)	Select state of control bus bits C0 through C15 for the following tag bus commands. Bits are strobed into the drive when the START (STROBE) pushbutton is pressed.																		
	<table><tr><th>Command</th><th>Control Bits</th></tr><tr><td>Address Record (ADR) — 1001</td><td>C0 thru C5    Select sector address to be stored in drive Sector Address register.</td></tr><tr><td></td><td>C8 and C9    Select head identity to be stored in drive Head register.</td></tr><tr><td>Address Unit (ADU) — 1010</td><td>C0 thru C2    Select identity of drive to be enabled for communication with DSU. (The identity of the drive is the number selected on the UNIT SELECT switch on the drive operator panel.)</td></tr><tr><td>Clear Status (CLS) — 1110</td><td>C0    Clears three Attention flip-flops in drive. This deactivates First Status signal. Note: If C0 and C1 are both selected, the Attention flip-flops and the First Status flip-flop are cleared.</td></tr><tr><td>Seek (SK) — 1000</td><td>C0 thru C8    Select cylinder address to which heads are to seek.</td></tr><tr><td>Set Offset (SOF) — 1101</td><td>C0 thru C5    Select offset magnitude in 53 increments of 25 microinches each.</td></tr><tr><td></td><td>C6    Selects direction (+ or -) of offset.</td></tr><tr><td>Transmit Sector (XMS) — 1100</td><td>C0 thru C5    Select sector address to be stored in drive Sector Address register.</td></tr></table>	Command	Control Bits	Address Record (ADR) — 1001	C0 thru C5    Select sector address to be stored in drive Sector Address register.		C8 and C9    Select head identity to be stored in drive Head register.	Address Unit (ADU) — 1010	C0 thru C2    Select identity of drive to be enabled for communication with DSU. (The identity of the drive is the number selected on the UNIT SELECT switch on the drive operator panel.)	Clear Status (CLS) — 1110	C0    Clears three Attention flip-flops in drive. This deactivates First Status signal. Note: If C0 and C1 are both selected, the Attention flip-flops and the First Status flip-flop are cleared.	Seek (SK) — 1000	C0 thru C8    Select cylinder address to which heads are to seek.	Set Offset (SOF) — 1101	C0 thru C5    Select offset magnitude in 53 increments of 25 microinches each.		C6    Selects direction (+ or -) of offset.	Transmit Sector (XMS) — 1100	C0 thru C5    Select sector address to be stored in drive Sector Address register.
Command	Control Bits																		
Address Record (ADR) — 1001	C0 thru C5    Select sector address to be stored in drive Sector Address register.																		
	C8 and C9    Select head identity to be stored in drive Head register.																		
Address Unit (ADU) — 1010	C0 thru C2    Select identity of drive to be enabled for communication with DSU. (The identity of the drive is the number selected on the UNIT SELECT switch on the drive operator panel.)																		
Clear Status (CLS) — 1110	C0    Clears three Attention flip-flops in drive. This deactivates First Status signal. Note: If C0 and C1 are both selected, the Attention flip-flops and the First Status flip-flop are cleared.																		
Seek (SK) — 1000	C0 thru C8    Select cylinder address to which heads are to seek.																		
Set Offset (SOF) — 1101	C0 thru C5    Select offset magnitude in 53 increments of 25 microinches each.																		
	C6    Selects direction (+ or -) of offset.																		
Transmit Sector (XMS) — 1100	C0 thru C5    Select sector address to be stored in drive Sector Address register.																		
C0 thru C15 LED indicators	<p>a. Indicate the state of the control bus bits selected by the lower band of 16 toggle switches when any one of the preceding six commands is selected.</p> <p>b. Indicate the status of the drive when any one of the following commands is selected:</p> <p>Read (READ) — 0000</p> <p>Write (WRITE) — 0001</p> <p>Request Status (RQS) — 0010</p>																		

**Table 4-2. DSU Functions 1,2,3, & 8 (cont'd)**

CONTROL/ INDICATOR	FUNCTION
	<p style="text-align: center;"><b>Function No. 8 — Manual Mode (Continued)</b></p> <p>Coding for the LED's is as follows. With the exception of C0 (ACRY), a lighted LED indicates that the corresponding signal is active. C0, when lighted, indicates that signal ACRY is inactive.</p> <p>C0 — ACRY (Access Ready)  C1 — DRDY (Drive Ready)  C2 — Illegal sector selected or seek check  C3 — First Status  C4 — FLT (Fault)  C5 — Format  C6 — PRT (Protect)  C7 — AT (Attention)  C8 — SC (Sector Compare)  C9 — Ground  C10 — Drive Type  C11 through C15 — Not used</p> <p>c. Indicate position information when Request Position (RQP) command is selected. Coding for the LED's is as follows:  C0 thru C5 — Sector presently under selected head.  C6 — RRT (Protect)  C7 — AT (Attention)  C8 and C9 — Identity of selected head (0 thru 3)  C10 — Drive type  C11 thru C15 — Not used</p>

## 4-5. TROUBLESHOOTING FLOWCHARTS

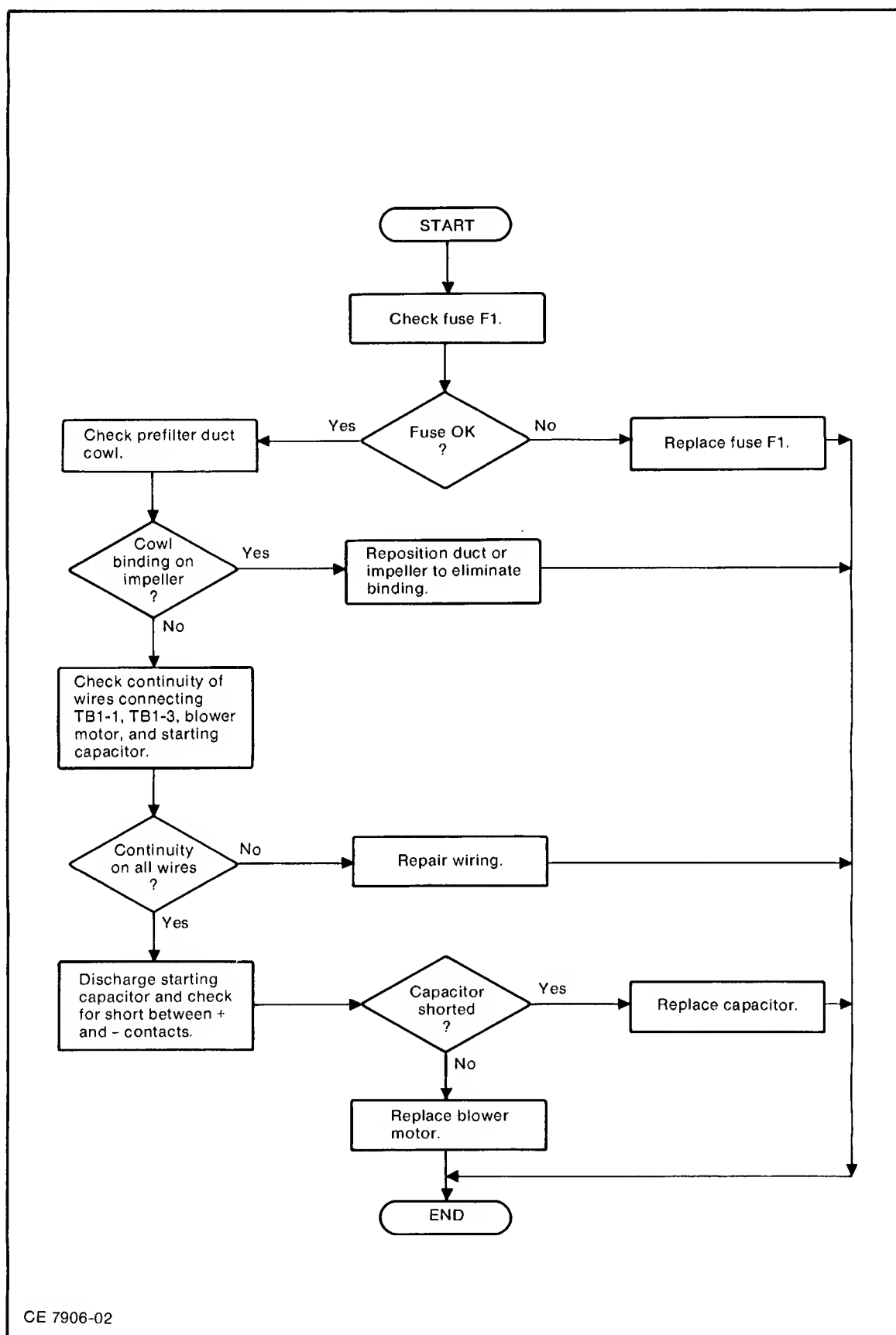


Figure 4-2. Blower Troubleshooting Flowchart

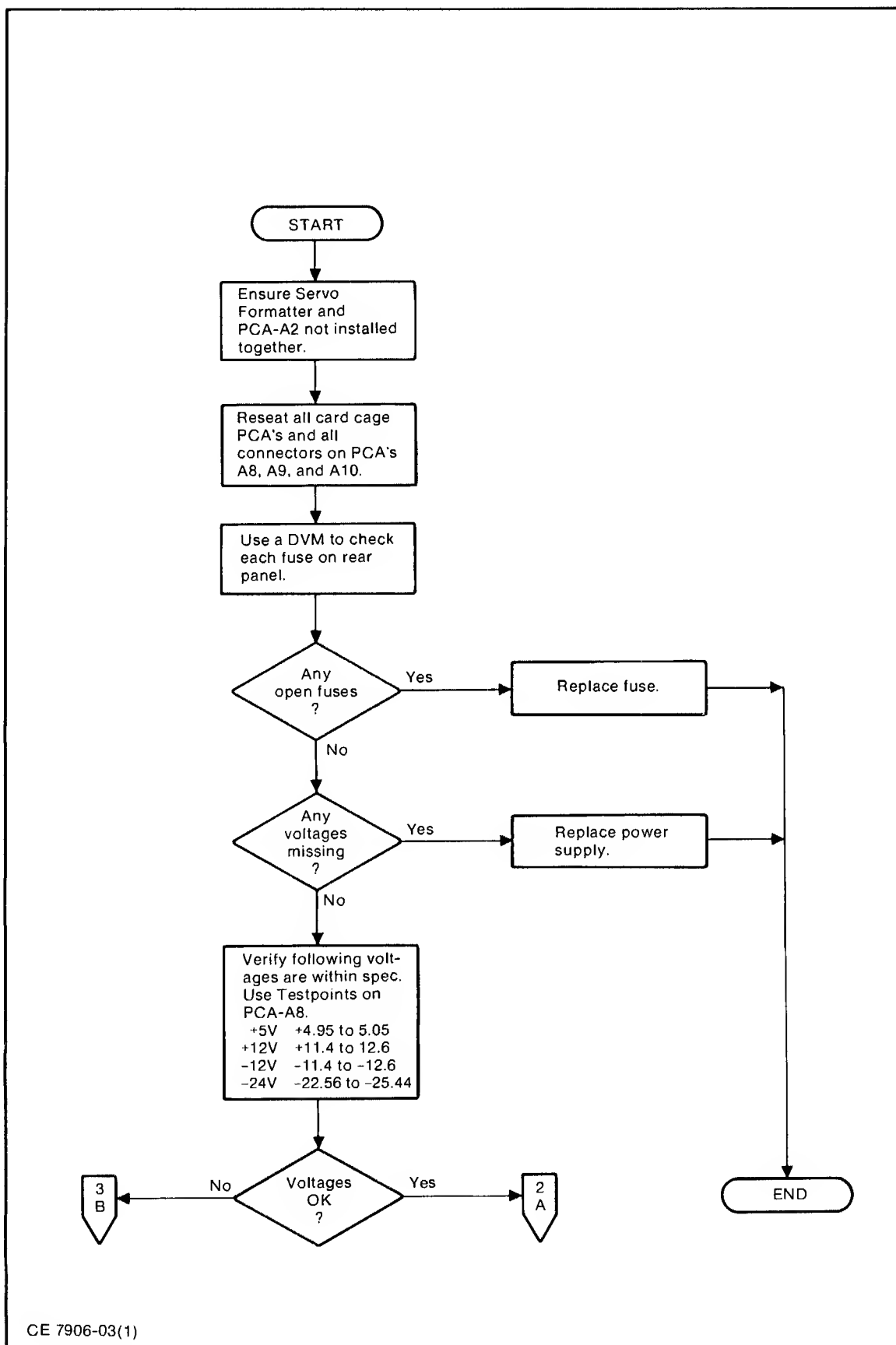
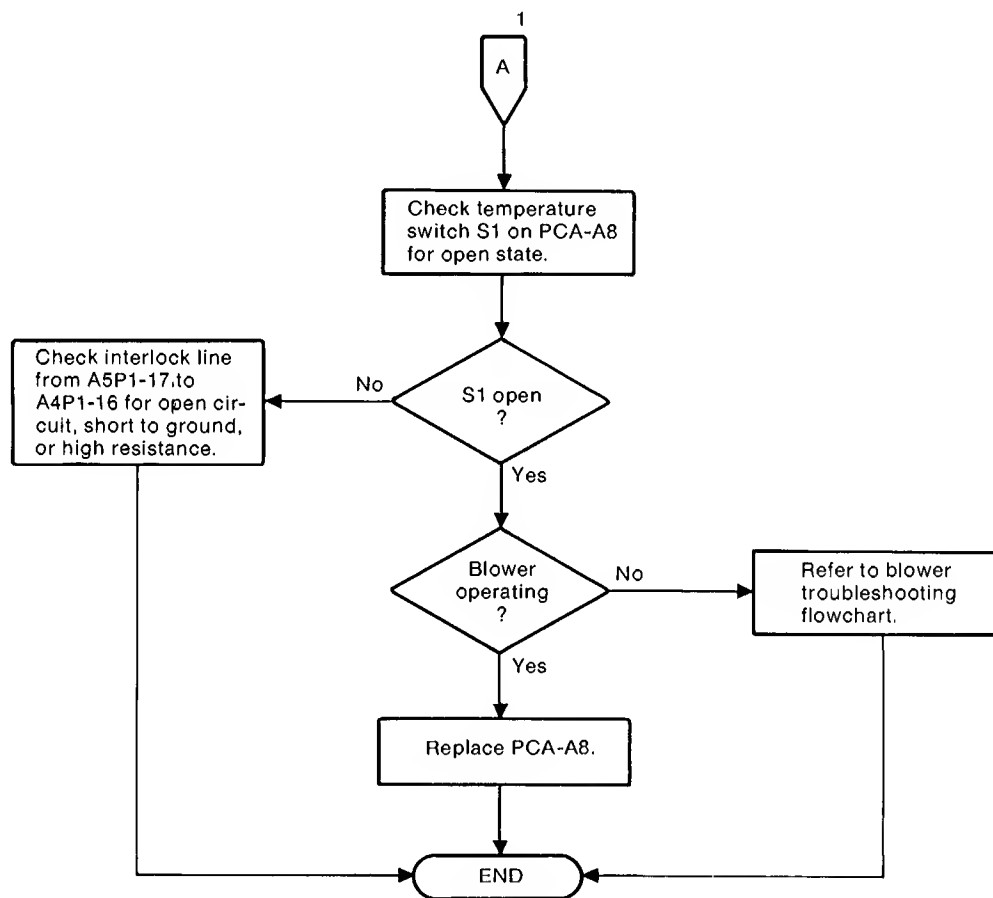
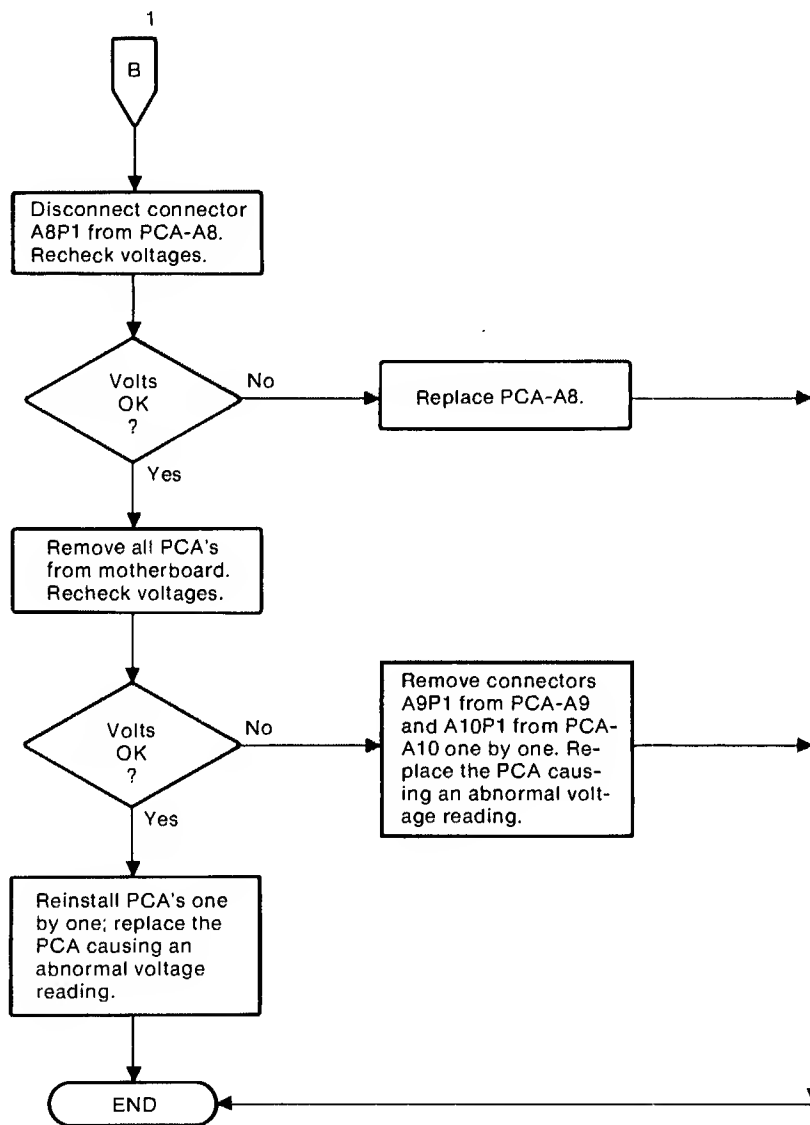


Figure 4-3. IL Drive Fault Indicator Troubleshooting Flowchart (1 of 3)



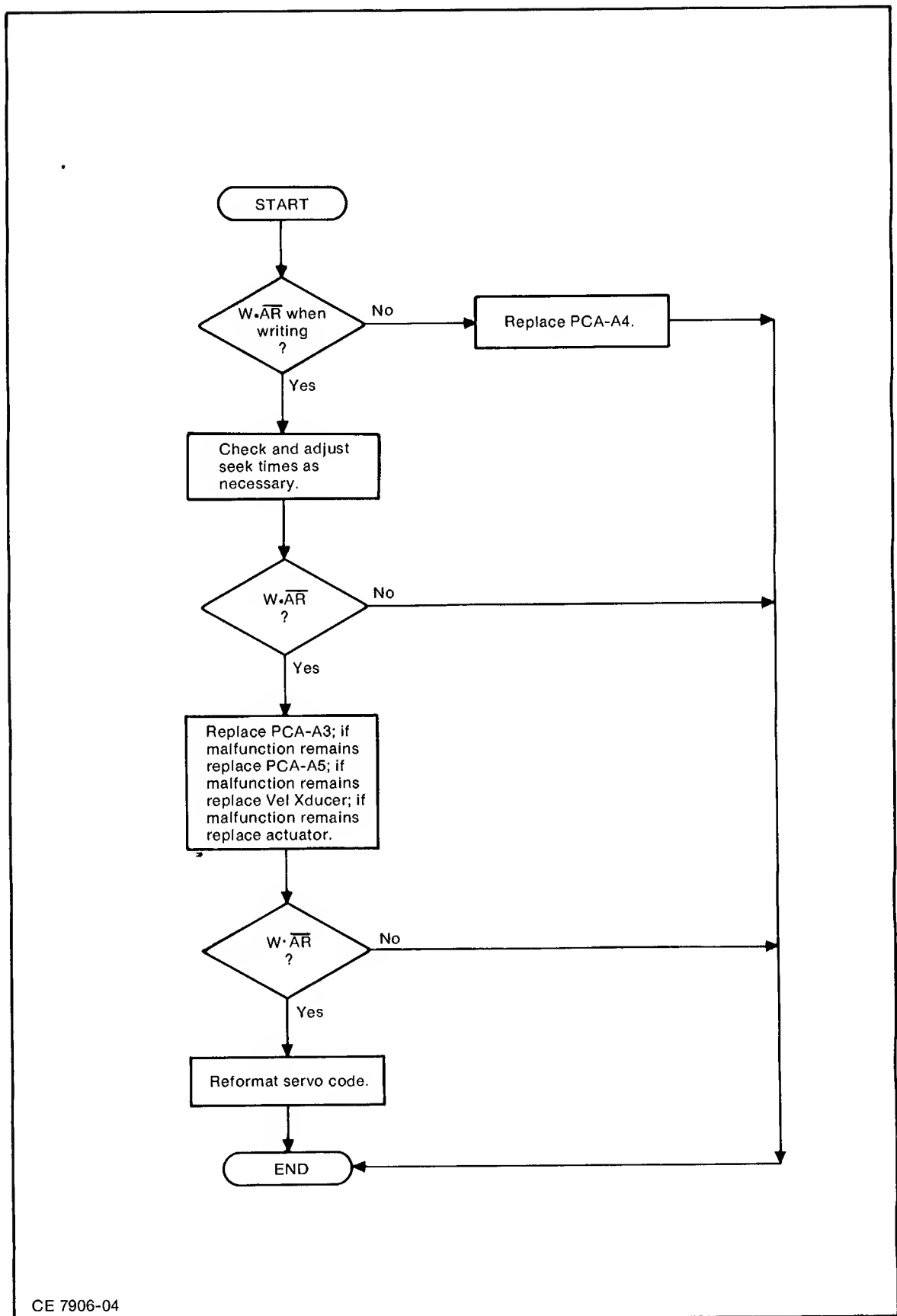
CE 7906-03(2)

Figure 4-3. IL Drive Fault Indicator Troubleshooting Flowchart (2 of 3)



CE 7906-03(3)

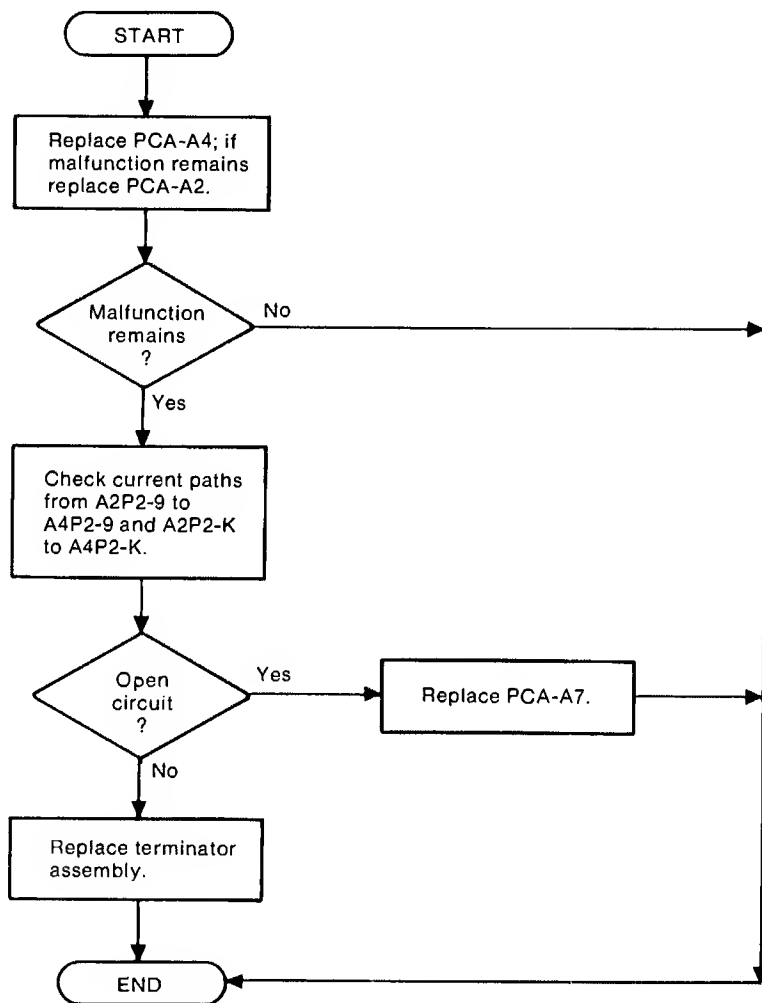
Figure 4-3. IL Drive Fault Indicator Troubleshooting Flowchart (3 of 3)



CE 7906-04

Figure 4-4.  $W \cdot \overline{AR}$  Drive Fault Indicator Troubleshooting Flowchart





CE 7906-05

Figure 4-5. R•W Drive Fault Indicator Troubleshooting Flowchart

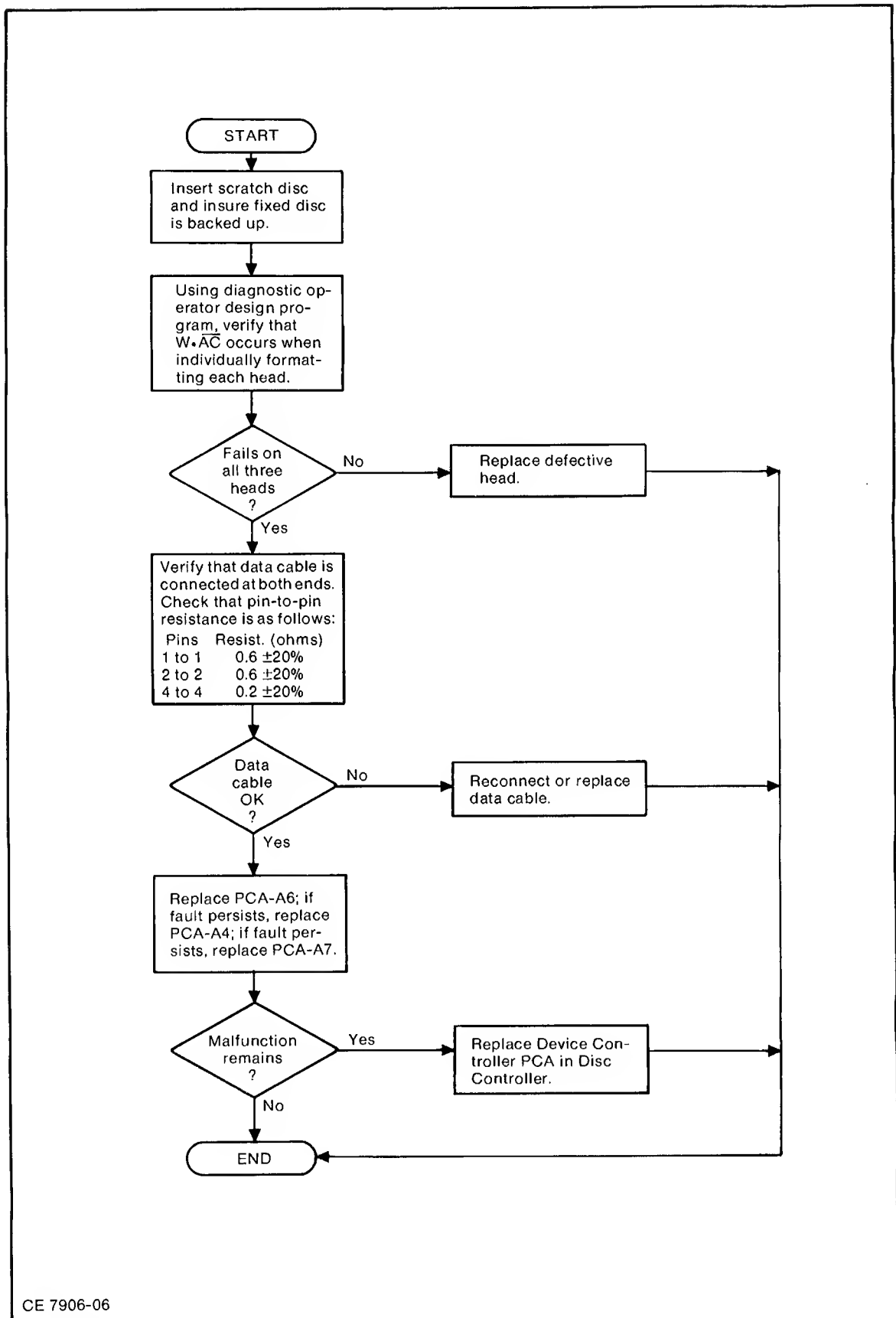
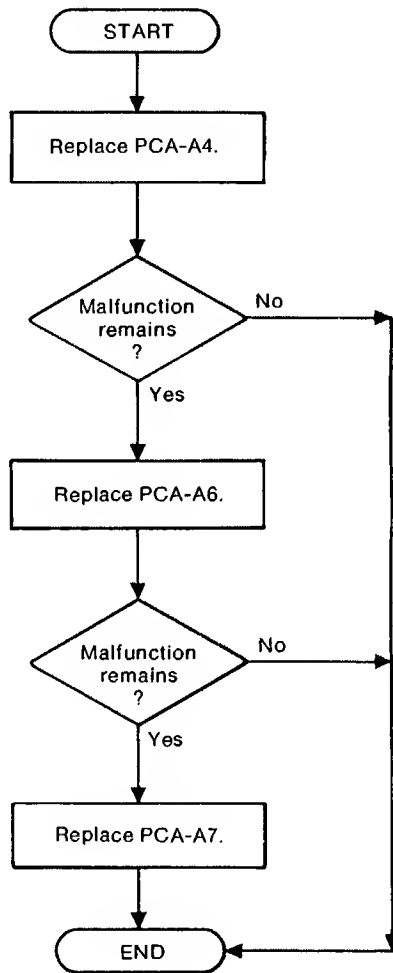
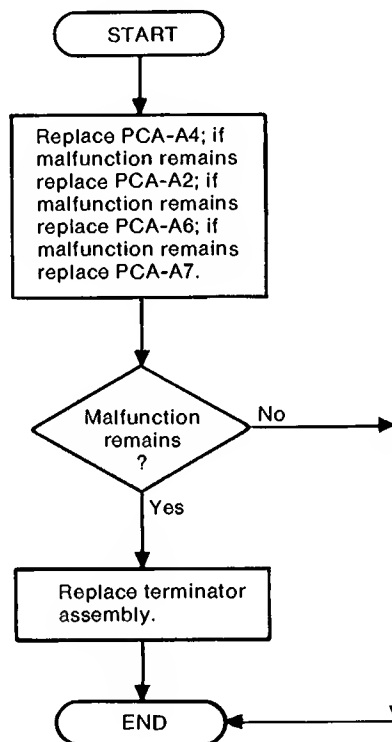


Figure 4-6. W•AC Drive Fault Indicator Troubleshooting Flowchart



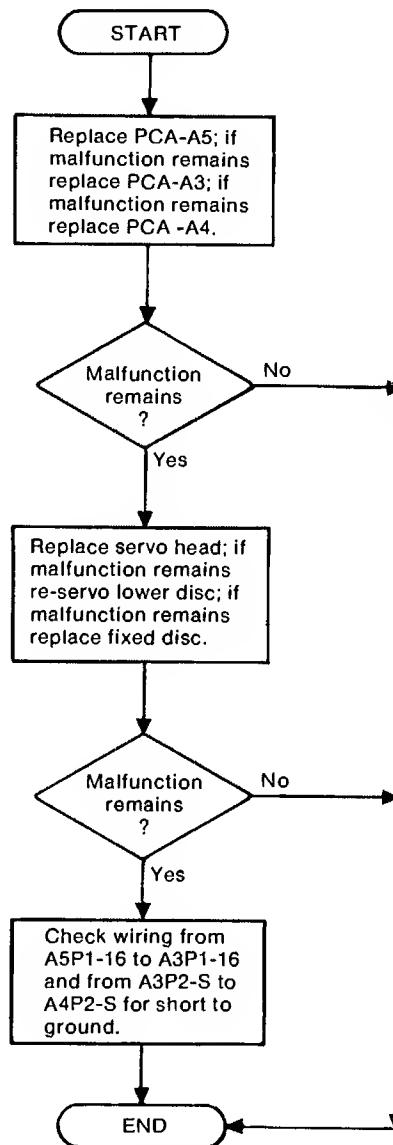
CE 7906-07

Figure 4-7. MH Drive Fault Indicator Troubleshooting Flowchart



CE 7906-08

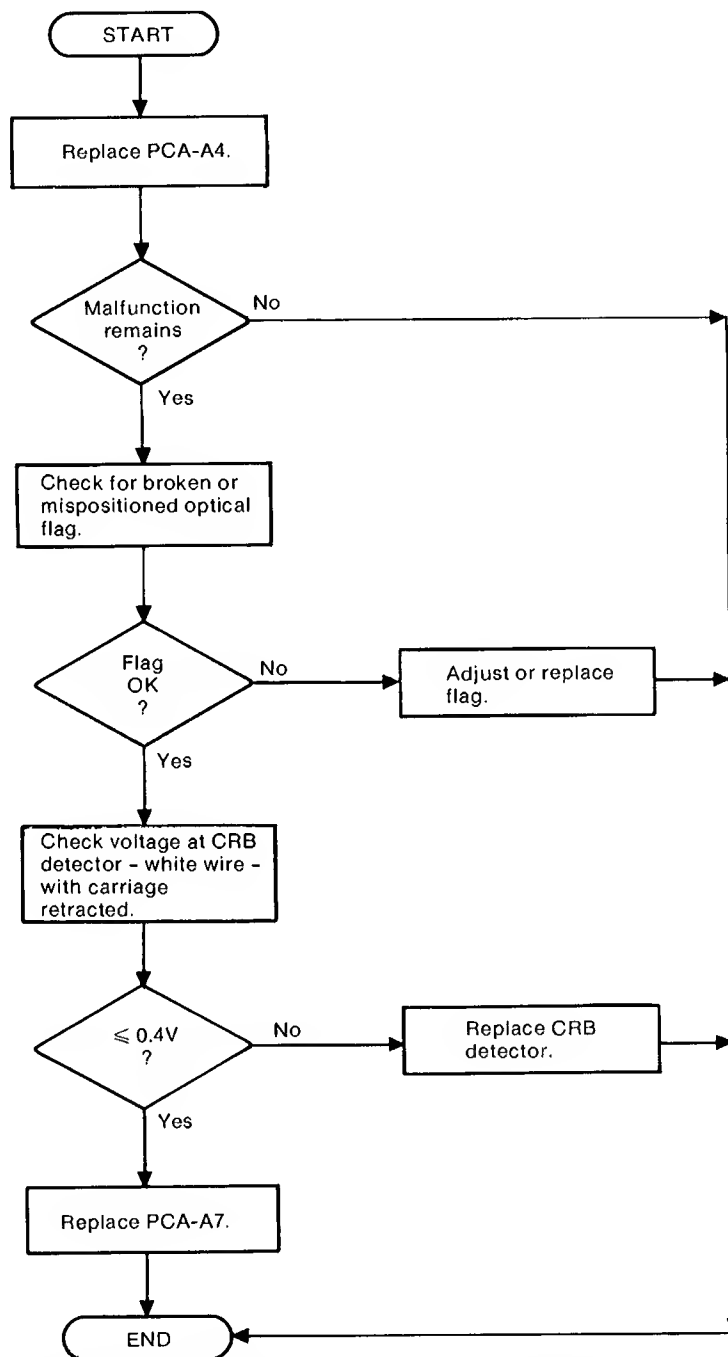
Figure 4-8. W•DC Drive Fault Indicator Troubleshooting Flowchart



Note: This fault condition is known to occur as the result of undesirable environmental conditions or power-related issues that must be considered if the above steps fail to resolve the malfunction.

CE 7906-09

Figure 4-9. AGC Drive Fault Indicator Troubleshooting Flowchart



Note: This fault condition is known to occur as the result of undesirable environmental conditions or power-related issues that must be considered if the above steps fail to resolve the malfunction.

CE 7906-10

Figure 4-10. CB Drive Fault Indicator Troubleshooting Flowchart

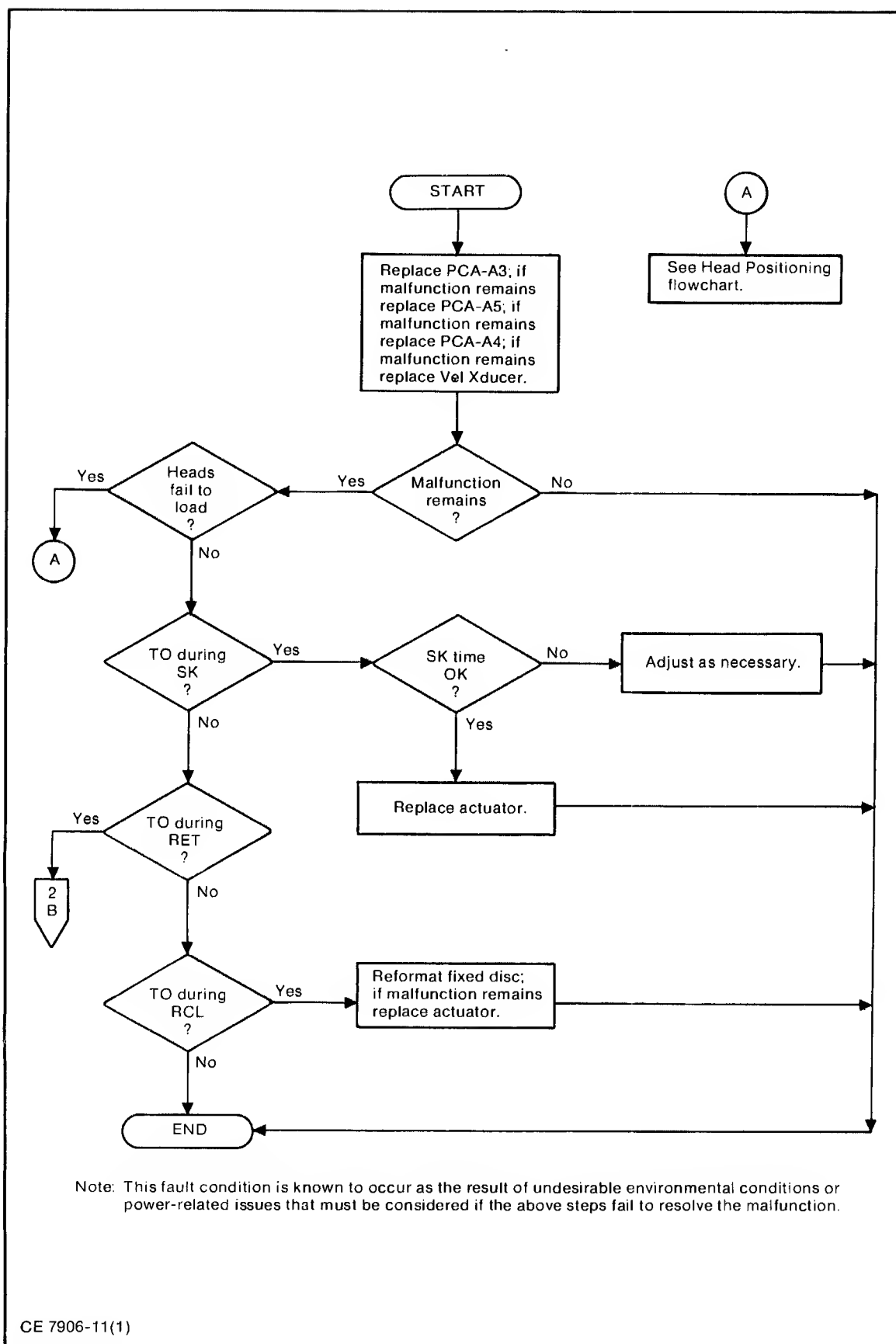
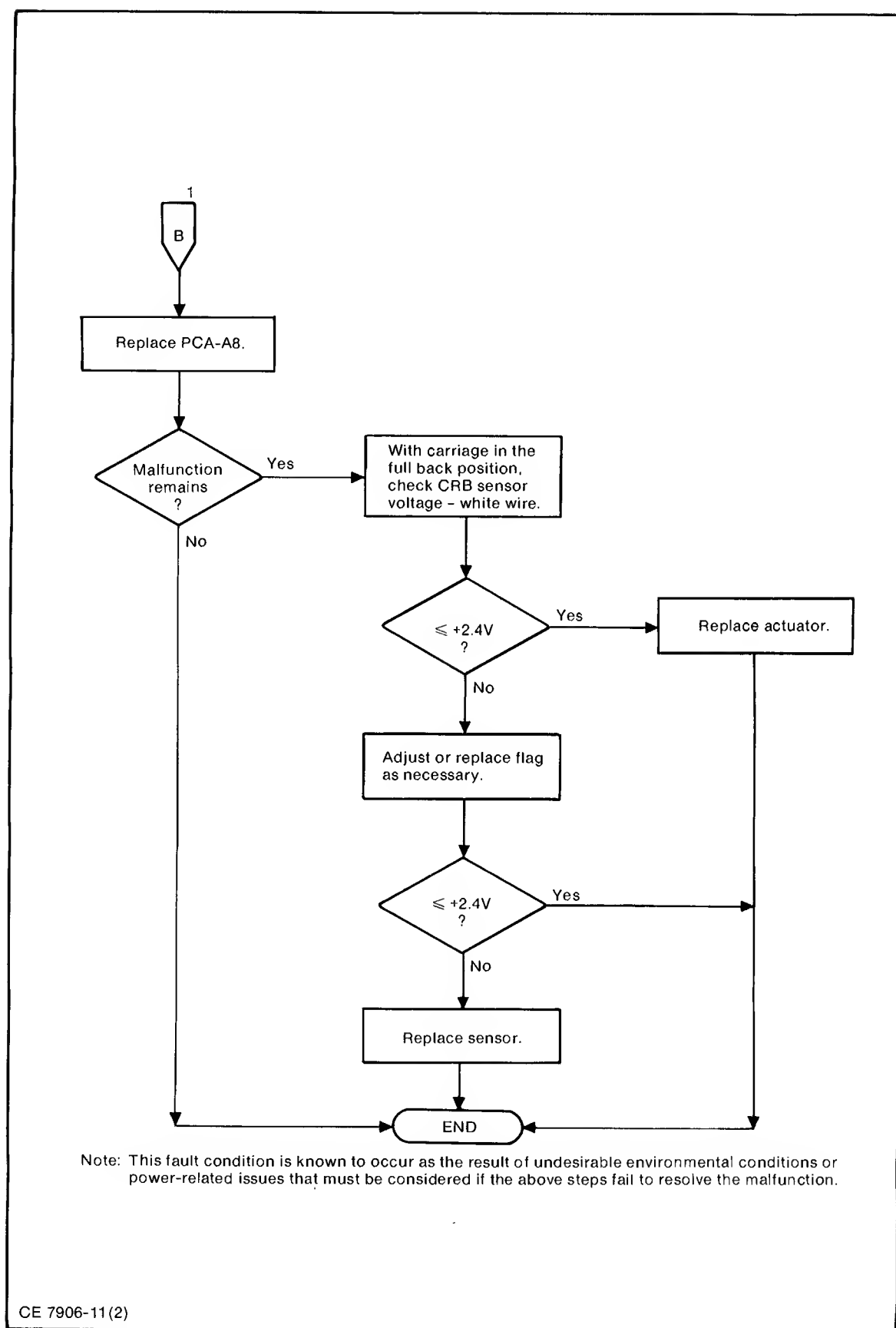
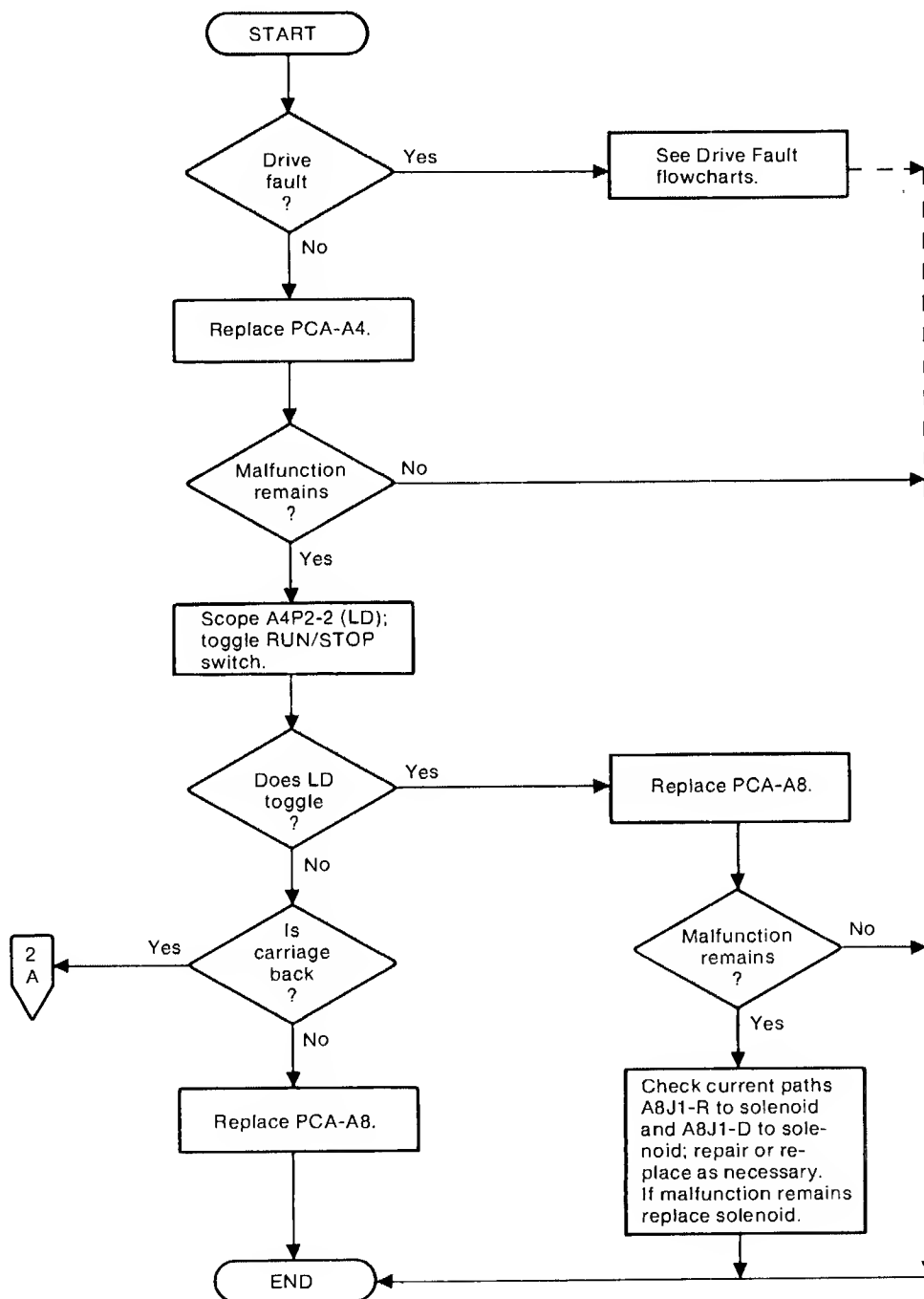


Figure 4-11. T.O. Drive Fault Indicator Troubleshooting Flowchart (1 of 2)



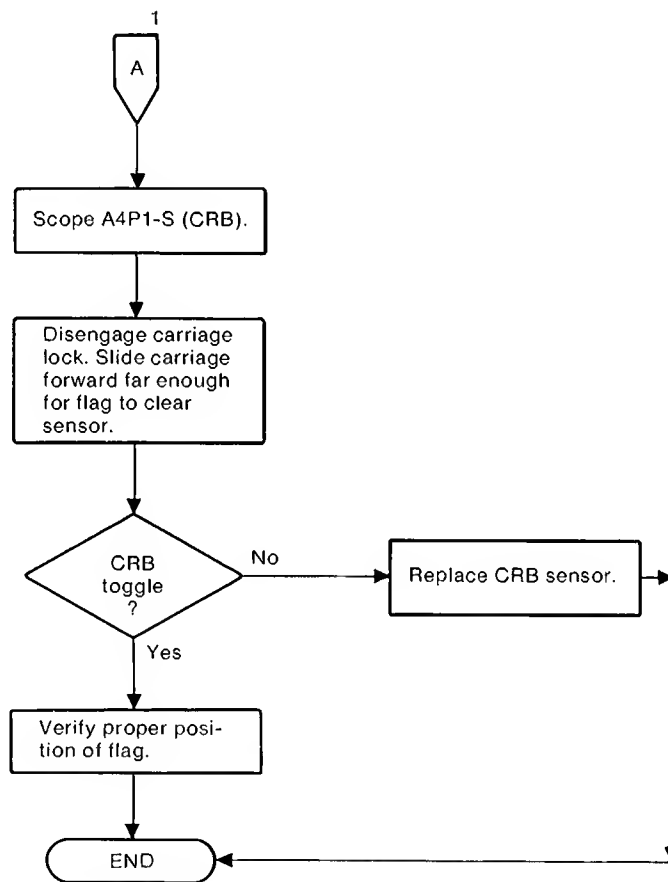
**Figure 4-11. T.O. Drive Fault Indicator Troubleshooting Flowchart (2 of 2)**





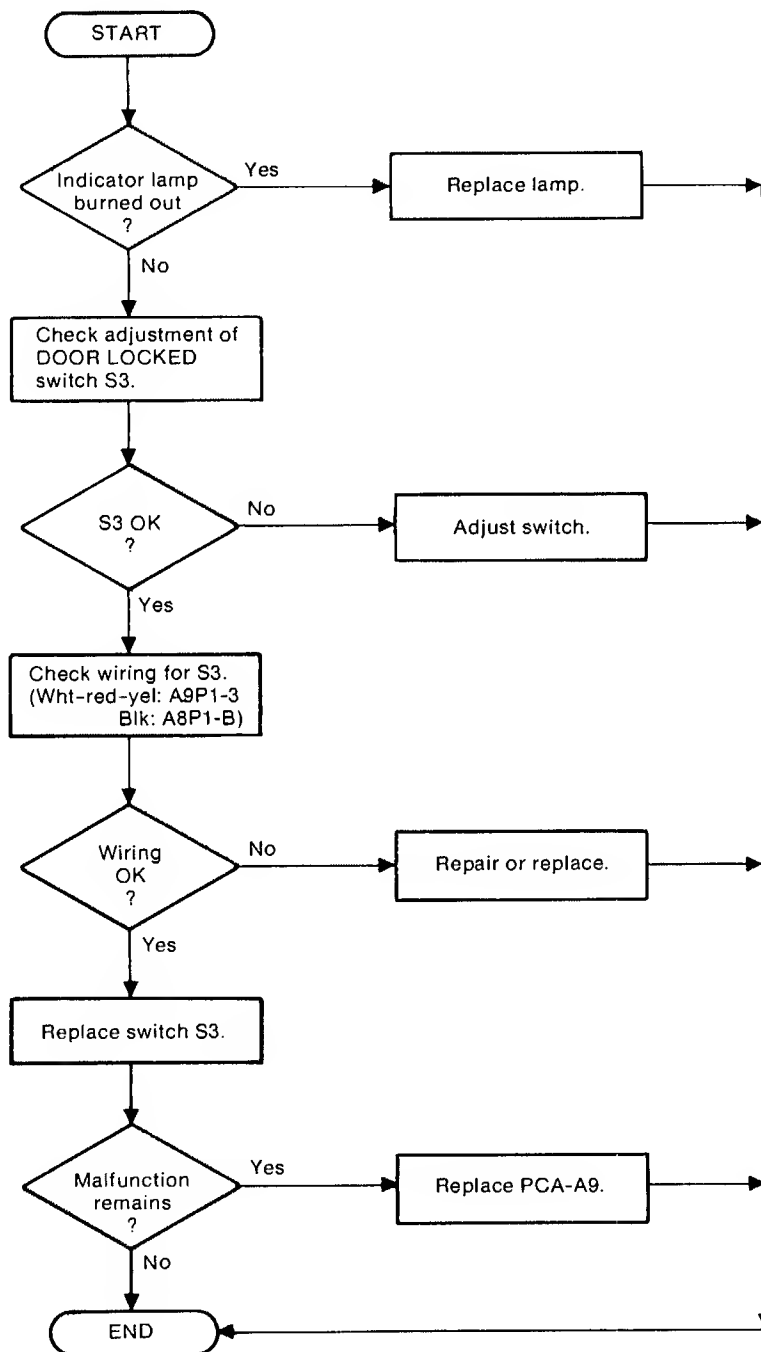
CE 7906-12(1)

Figure 4-12. Door Lock Solenoid Troubleshooting Flowchart (1 of 2)



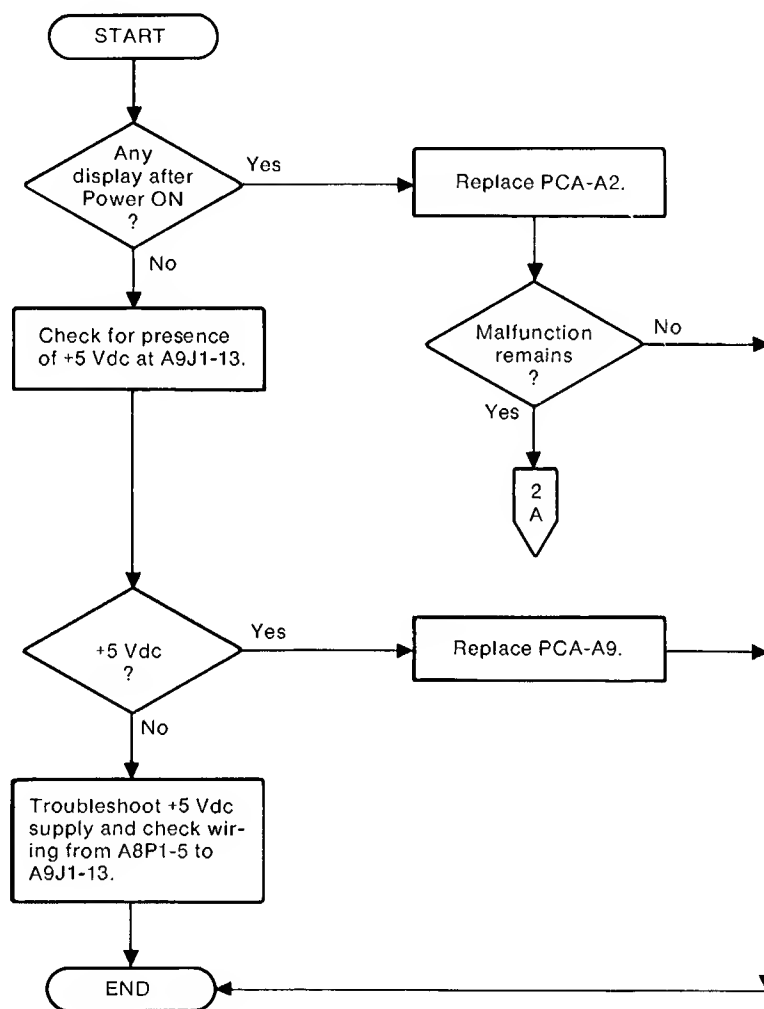
CE 7906-12(2)

Figure 4-12. Door Lock Solenoid Troubleshooting Flowchart (2 of 2)



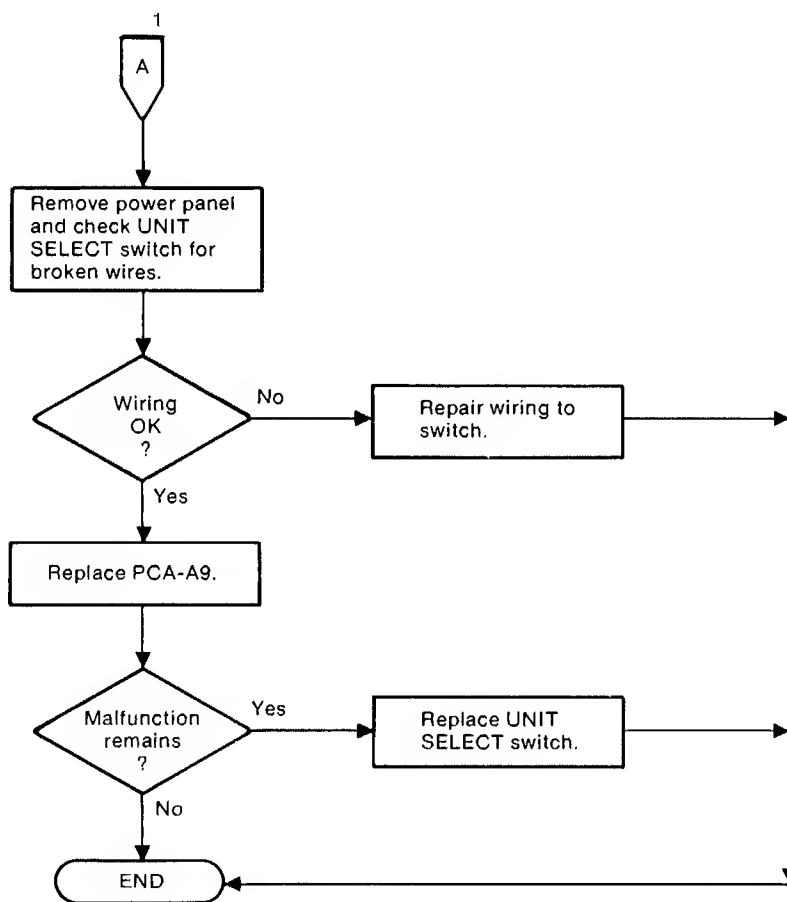
CE 7906-13

Figure 4-13. DOOR UNLOCKED Indicator Troubleshooting Flowchart



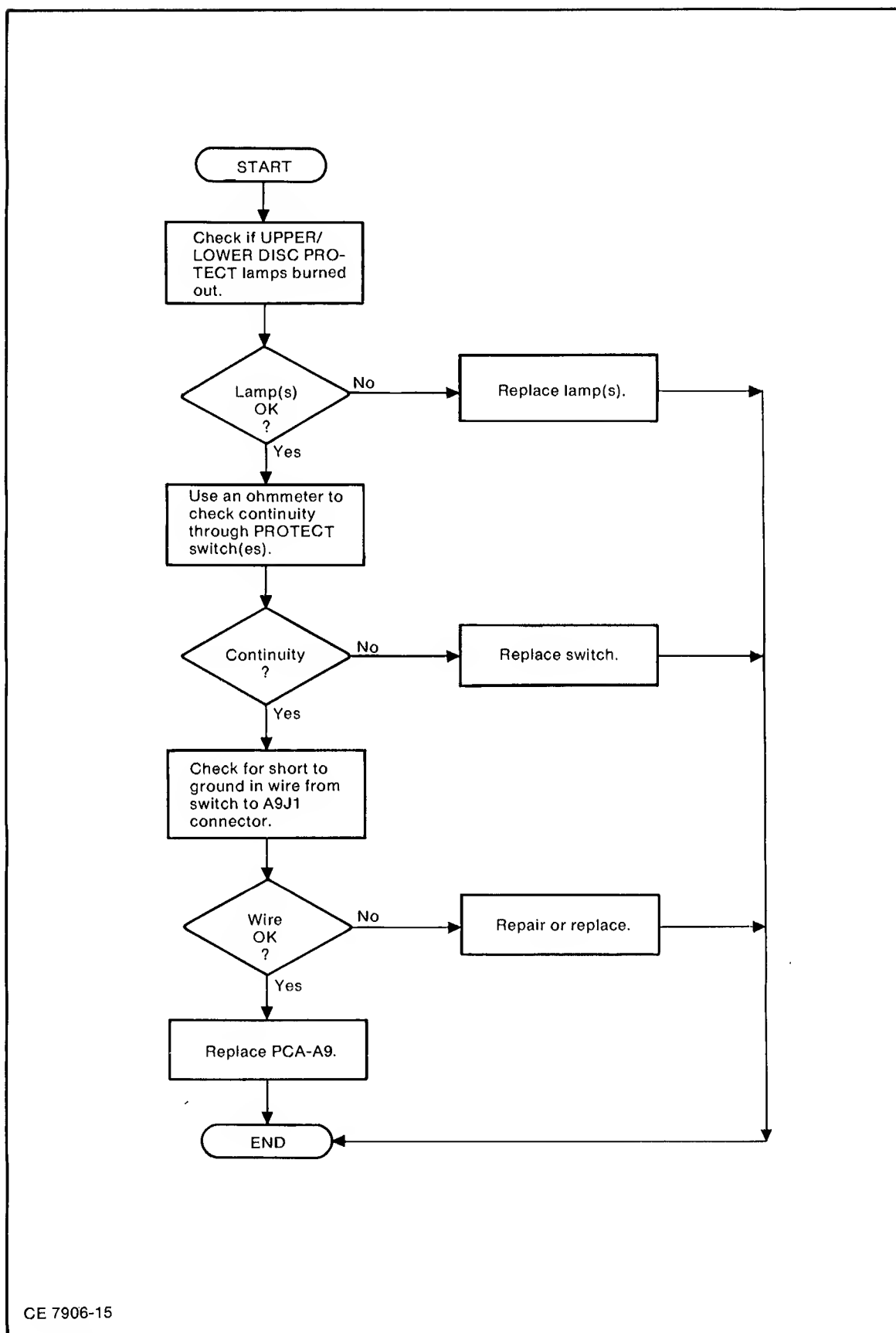
CE 7906-14(1)

Figure 4 - 14. Unit Select Indicator Troubleshooting Flowchart (1 of 2)



CE 7906-14(2)

Figure 4-14. Unit Select Indicator Troubleshooting Flowchart (2 of 2)



CE 7906-15

Figure 4-15. DISC PROTECT Indicator Troubleshooting Flowchart

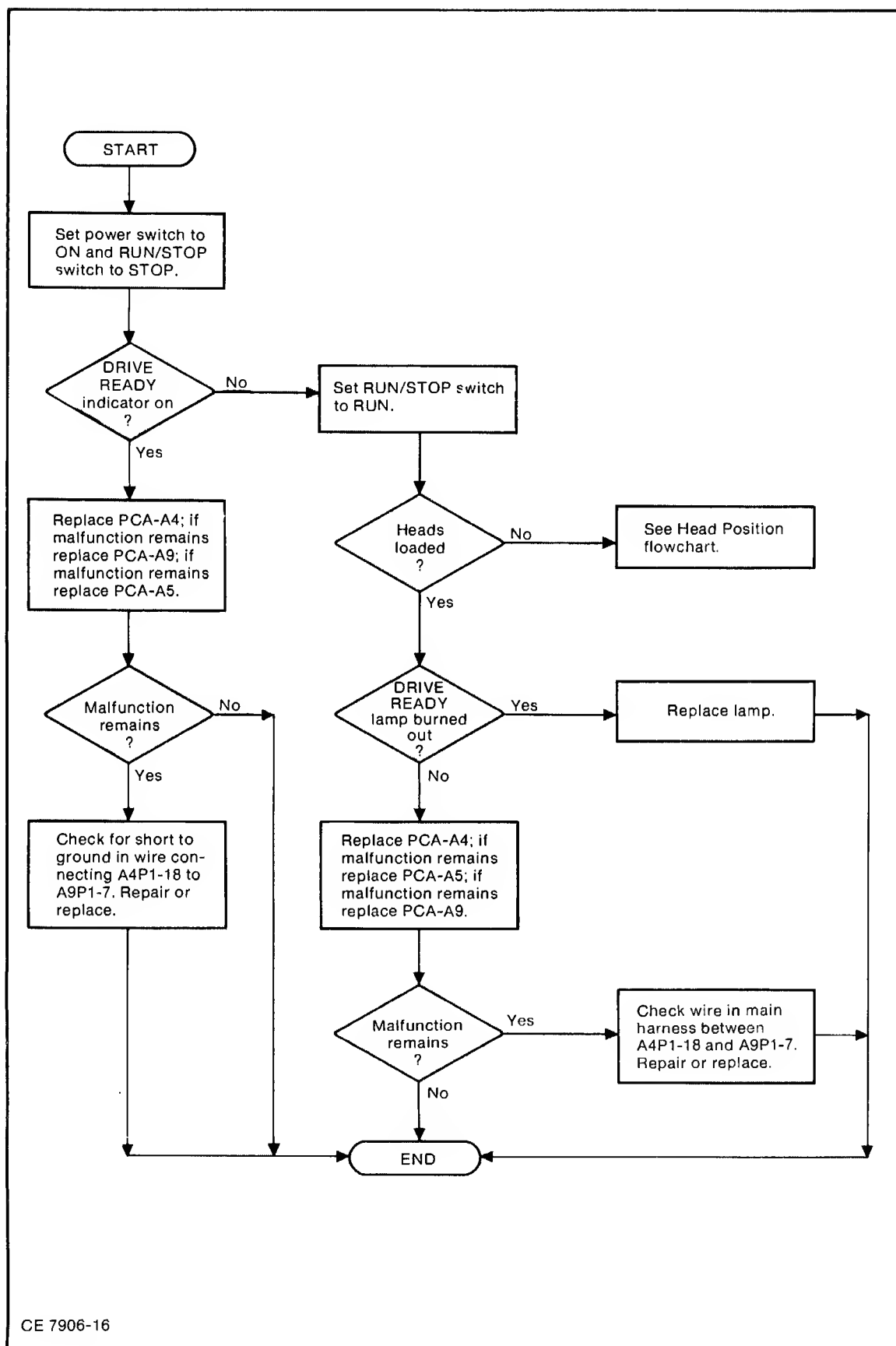


Figure 4-16. DRIVE READY Indicator Troubleshooting Flowchart

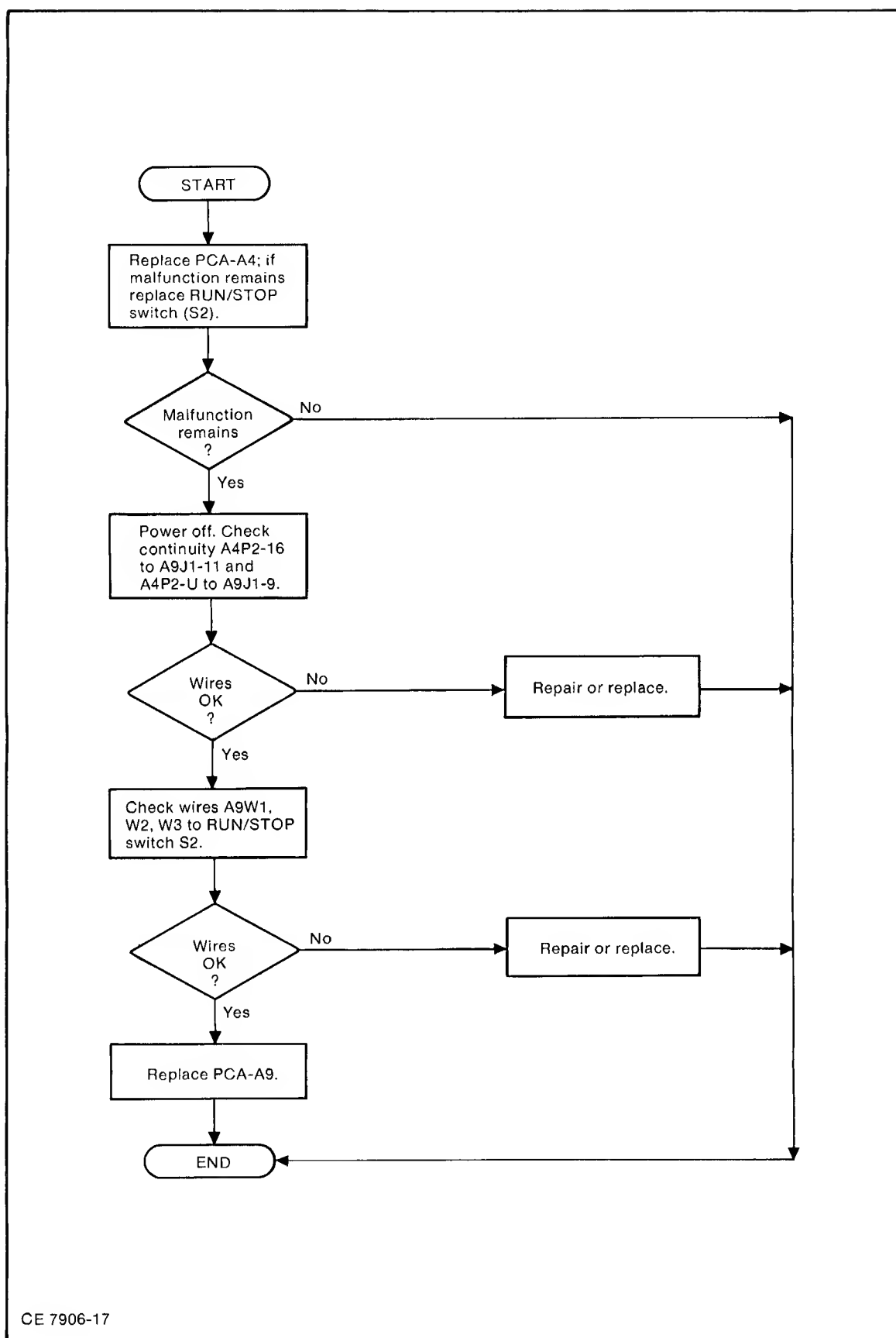
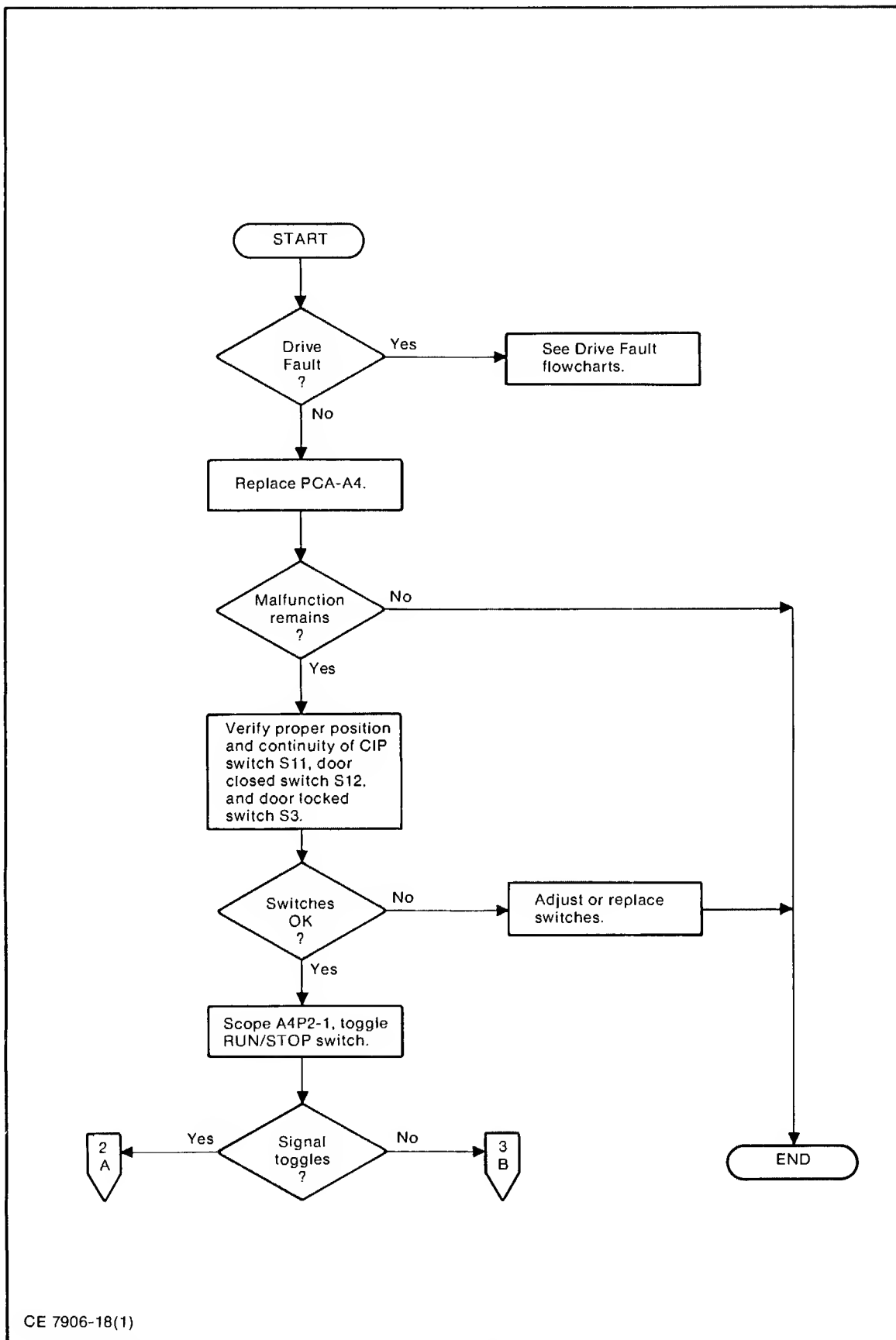


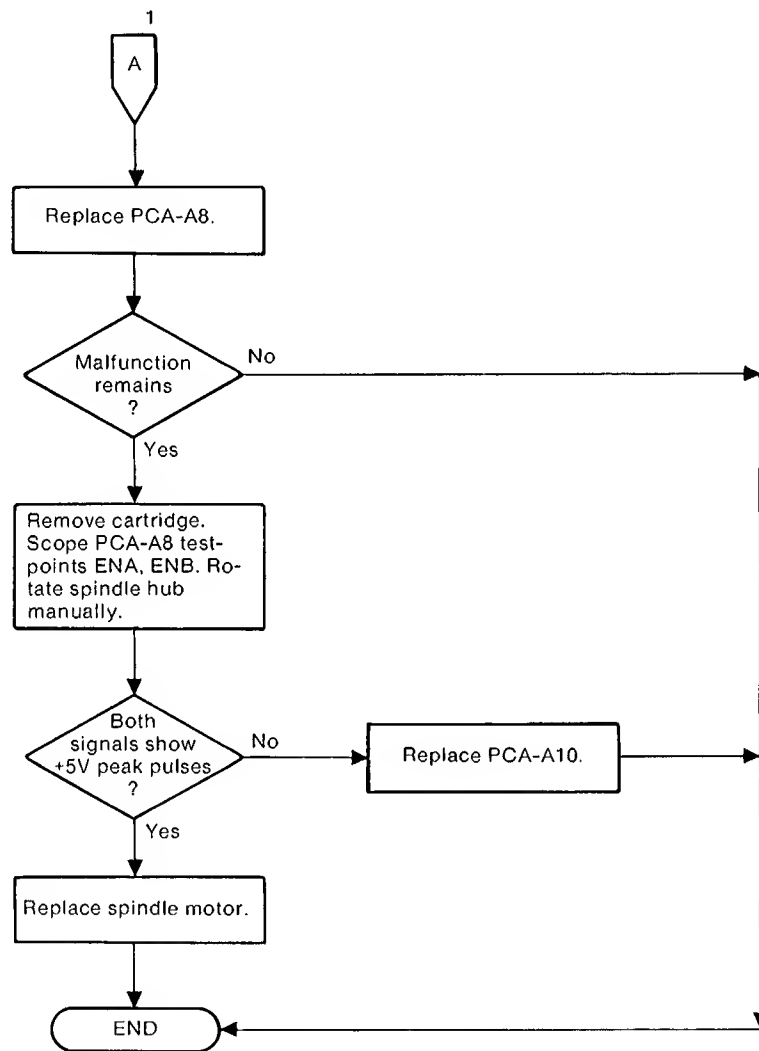
Figure 4-17. RUN/STOP Switch Troubleshooting Flowchart





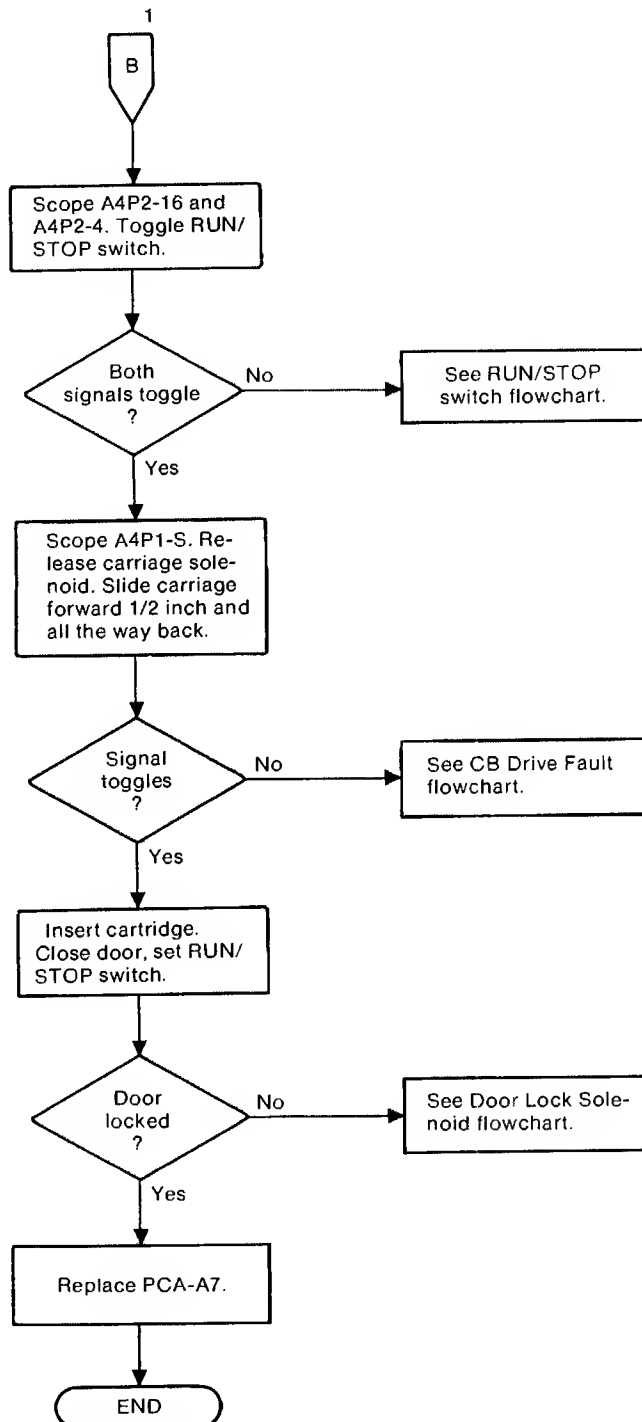
CE 7906-18(1)

Figure 4-18. Spindle Rotating Troubleshooting Flowchart (1 of 3)



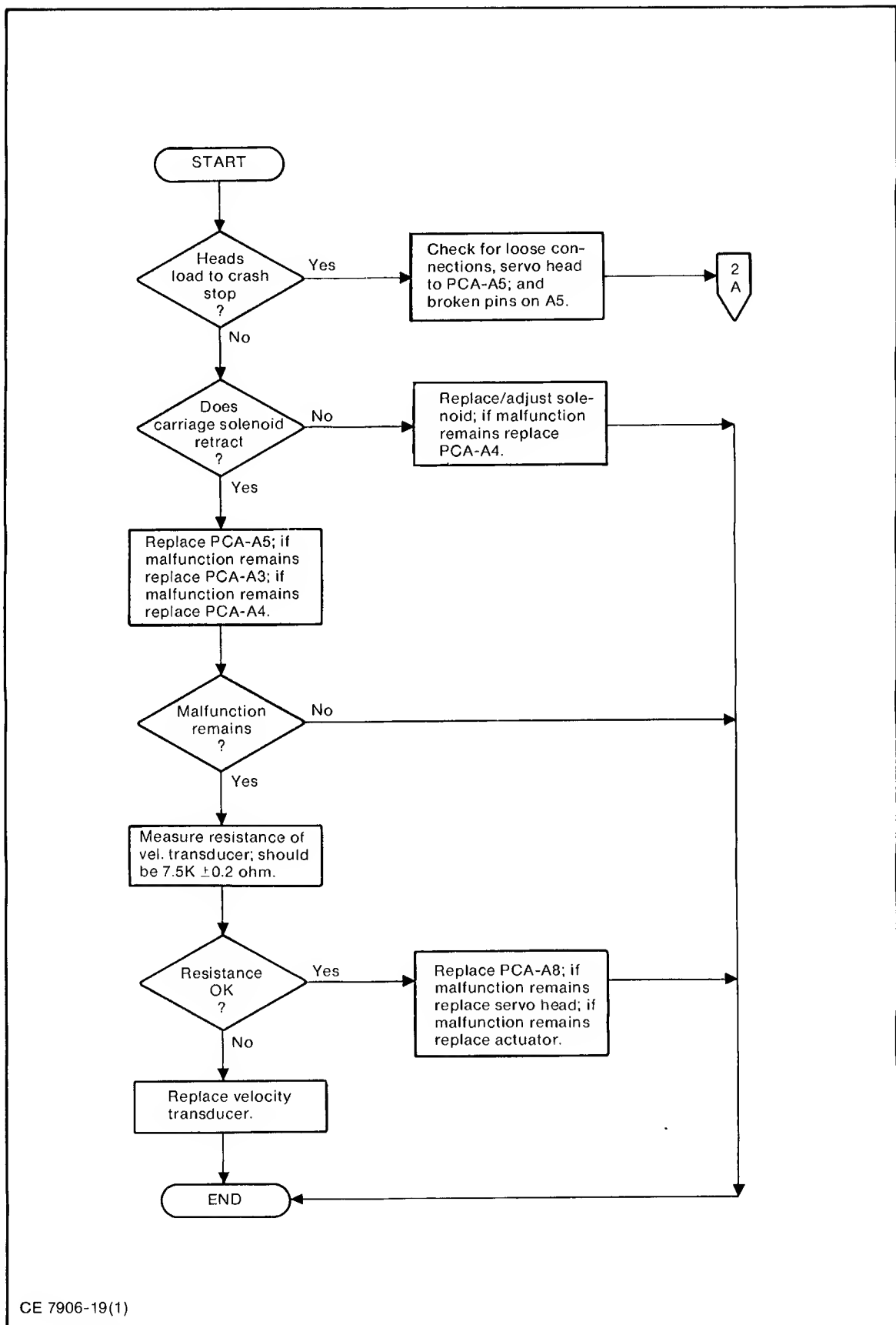
CE 7906-18(2)

Figure 4 - 18. Spindle Rotating Troubleshooting Flowchart (2 of 3)



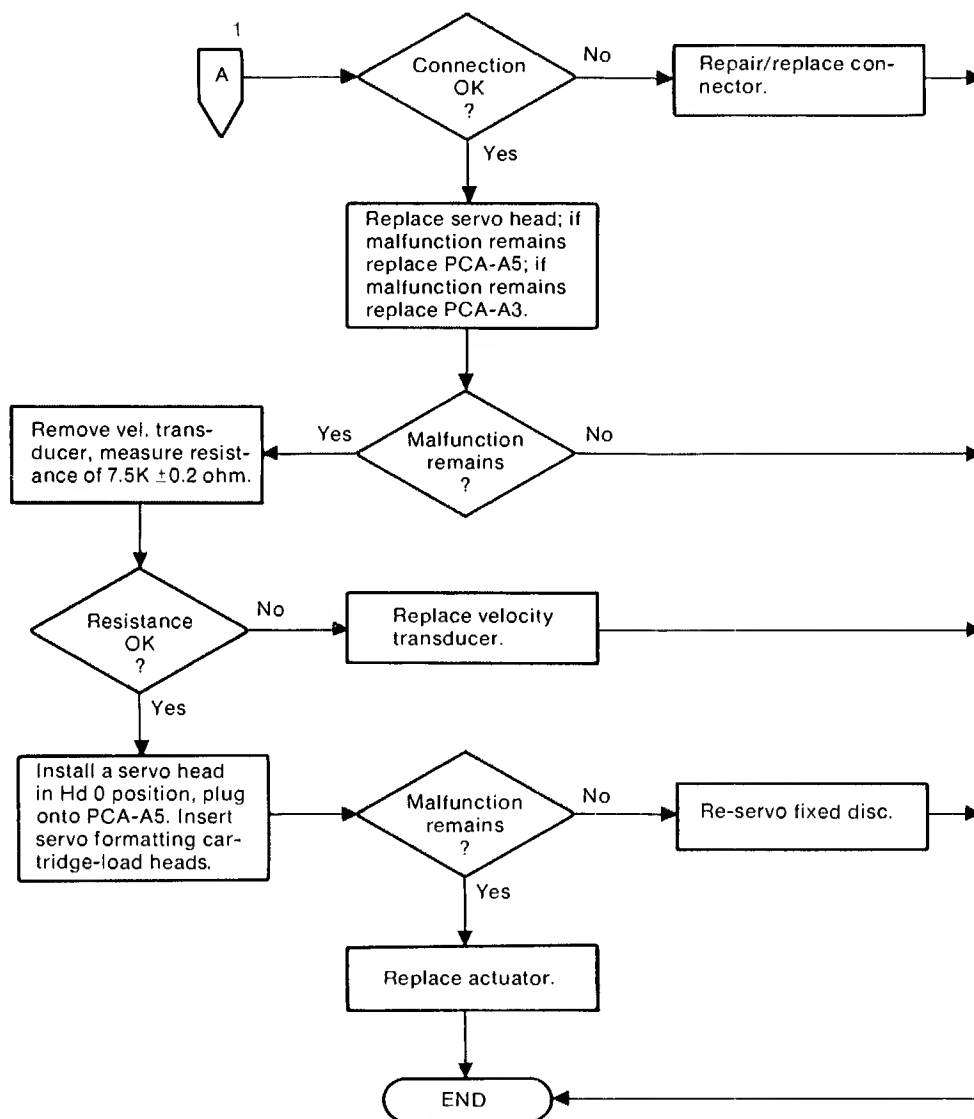
CE 7906-18(3)

Figure 4 - 18. Spindle Rotating Troubleshooting Flowchart ( 3 of 3)



CE 7906-19(1)

Figure 4-19. Head Positioning Troubleshooting Flowchart (1 of 2)



CE 7906-19(2)

Figure 4-19. Head Positioning Troubleshooting Flowchart (2 of 2)

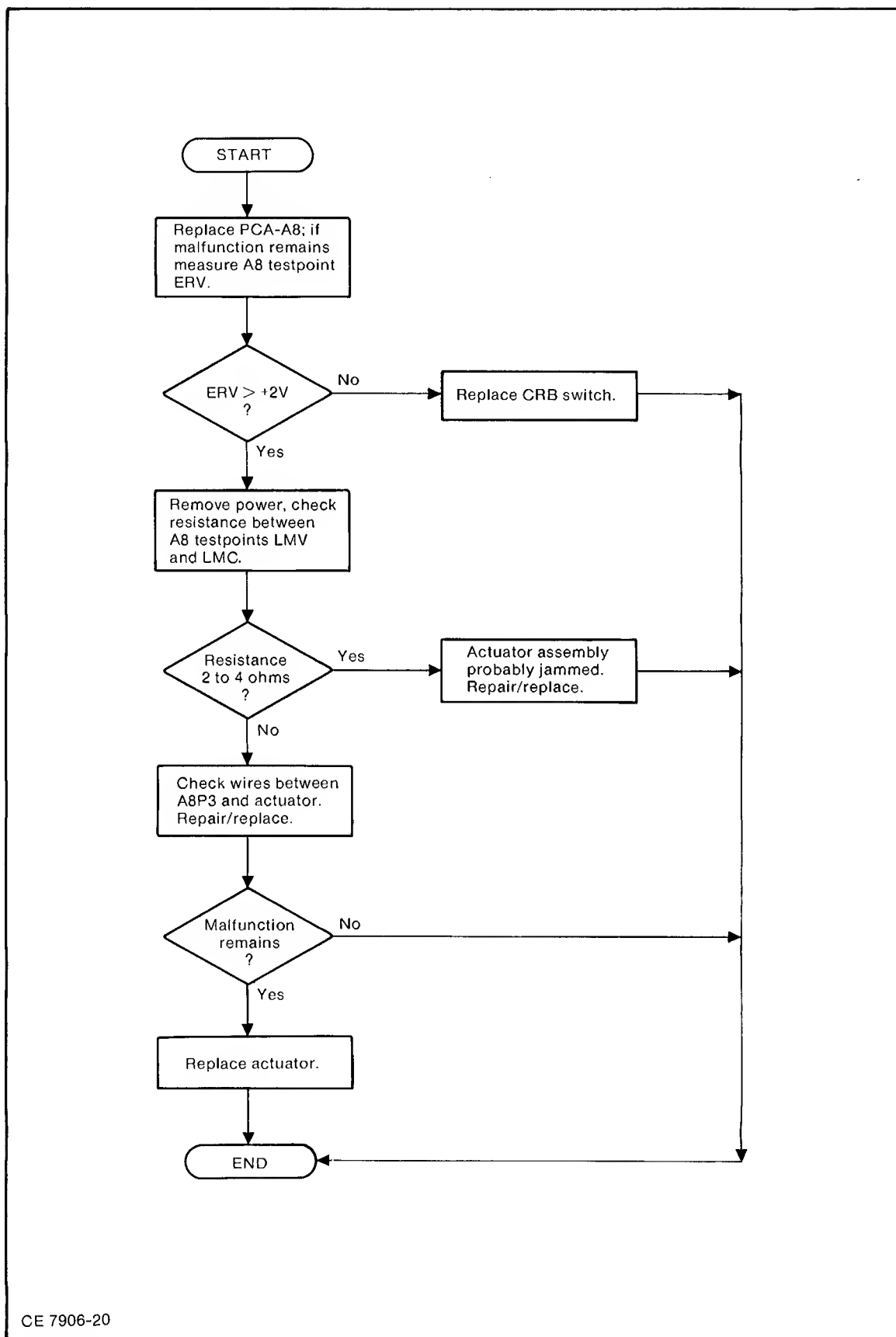


Figure 4-20. Emergency Return (CRB) Indicator Troubleshooting Flowchart

# **DIAGNOSTICS**

**SECTION**

**V**

ONLY THE "H" MODEL DRIVE CONTAINS A SELF-TEST FEATURE,  
REFER TO APPENDIX A.

FOR HOST-RUN DIAGNOSTICS, REFER TO TABLES 5-1 AND 5-2.

Table 5-1. System Diagnostics

### HP 1000 M, E, F SERIES

TITLE: HP79XX/13037 Disc Memory Diagnostic

MANUAL P/N: 12962-90001

DIAGNOSTIC MEDIA: 2645 Cartridges (24396-13306)  
7900 Disc (24396-13001)  
7905 Disc (24396-13501)  
7970 B Mag Tape (24396-13501)  
7970 E Mag Tape (24396-13601)

### HP 1000 A, L SERIES

TITLE: HP 1000 ICD/MAC Disc Diagnostic

MANUAL P/N: 5955-4355

DIAGNOSTIC MEDIA: 2645 Cartridge (24398B #20)  
CS/80 Tape-Linus (24398B #22)  
8 in. Floppy (24398B #41)  
5.25 in. Floppy (24398B #42)  
3.5 in. Floppy (24398B #44)  
7970E Mag Tape (24398B #51)

### HP 9835/9845 DESKTOP

TITLE: DISCO, DISKEY

MANUAL P/N: (Integrated with diagnostic - HELP)

DIAGNOSTIC MEDIA: 9845 Tape Cartridge (98041-90010)

### HP 3000 SERIES III

TITLE: Disc Verifier (SLEUTH, SLEUTH-07)

MANUAL P/N: (Integrated with diagnostic)

DIAGNOSTIC MEDIA: 7970E Mag Tape (32230-90002)

TITLE: WORKOUT2

MANUAL P/N: 30000-90172 (HP 3000 III CE Handbook)

DIAGNOSTIC MEDIA: (On-line, integrated with op system)

TITLE: Colossus

MANUAL P/N: (Integrated with diagnostic - HELP)

DIAGNOSTIC MEDIA: 7970E Mag Tape (35074A)

### HP 250 SERIES


TITLE: Hard Disc Diagnostic

MANUAL P/N: 45000-94000 (CE Handbook)

DIAGNOSTIC MEDIA: CS/80 Tape-Linus (45260-19001)  
8-in. Floppy (45260-18001)



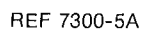
Table 5-2. Status Words for MAC Drives

Status Word 1		
15	0	Track flagged spare
14	1	Track flagged protect
13	2	Track flagged defective
12	3	Encoded status (000000) 00000 Normal complete
		(000400) 00001 Illegal op code
11	4	Encoded status (001000) 00010 Unit available
10	5	Encoded status (003400) 00111 Cylinder compare error
9	6	Encoded status (004000) 01000 Uncorrectable error
		(004400) 01001 Head/sector compare error
8	7	Encoded status (005000) 01010 I/O program error
7	8	reserved (006000) 01100 End of cylinder
6	9	reserved (007000) 01110 Data over-run
		(007400) 01111 Possible correctable error
5	10	reserved (010000) 10000 Illegal access to spare track
4	11	reserved (010400) 10001 Defective track
3	12	Unit number (011000) 10010 Access not ready during data op
		(011400) 10011 Status 2 error
2	13	Unit number (013000) 10110 Attempt to write on protected trk
1	14	Unit number (013400) 10111 Unit not available
0	15	Unit number (017400) 11111 Drive attention (seek complete)
Status Word 2		
15	0	Status word 2 error
14	1	Drive type 000000 = 7906
13	2	Drive type 000001 = 7920
12	3	Drive type 000010 = 7905
		000011 = 7925
11	4	Drive type
10	5	Drive type
9	6	Drive type
8	7	reserved
7	8	Attention required
6	9	Write protected
5	10	Format switch on
4	11	Drive fault
3	12	First status (Heads just loaded over media)
2	13	Seek check Caused by invalid cylinder, head or sector address,
1	14	Drive not ready or multiple seeks requested
0	15	Drive busy
 <b>3000 Bit Format</b> <b>1000 Bit Format</b>		

## SECTION VI

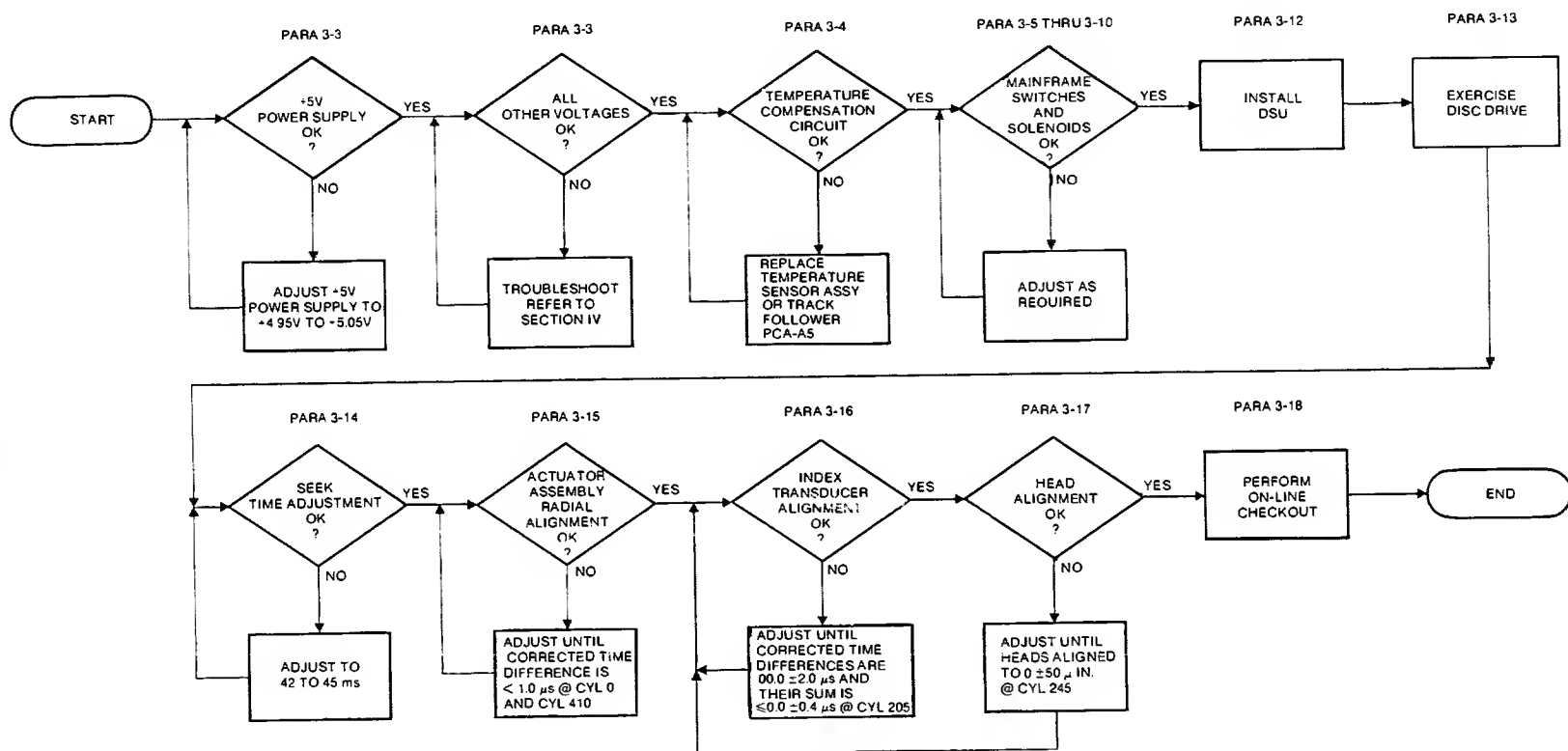
**See figure on next page for sequence of adjustments**

See figure below for procedure, plus tolerances for other DC voltages.



**6-1**

Figure 6-2. Adjustment Sequence Flowchart



## 6-3. COARSE ADJUSTMENTS

Whenever the linear actuator and fixed disc are removed or replaced simultaneously, the following "coarse adjustments" must be performed (prior to reformatting the servo code.)

## 6-4. COARSE INDEX TRANSDUCER ALIGNMENT

### A. SETUP

1. Install a servo head in place of head 0.
2. Position the head as far forward as possible with reference to the initial position tool.
3. Connect this head to the track follower PCA.
4. Install head alignment PCA, alignment preamp, DSU and servo formatting cartridge.
5. Turn both PROTECT switches ON.

### B. MEASURE OUTPUT

1. Turn ac power ON and RUN/STOP switch to RUN.
2. Connect an oscilloscope probe to P2-H on the I/O sector PCA (this is the output of the index transducer).
3. Make sure the amplitude is greater than +9V -p and the pulses are 16.67ms apart. If not, go to step D-2 below.

### C. MOVE HEADS

1. Select DSU FUNCTION 5 and turn on HEAD 1 toggle switch.
2. Push START and drive should seek to cylinder 205.
3. Short the "POS" signal on track follower to ground and slowly move heads inward until the needle on the DSU pegs to the left.
4. Disconnect ground and servo will lock. Note reading on digital display.

### D. FINAL ADJUST

1. Digital display must be within 10 units of zero. If not:
2. Set RUN/STOP switch to STOP, remove cartridge, install index transducer alignment hub.
3. Remove lower front frame and disconnect indicator panel connector.
4. Make sure slotted head pivot screw on transducer bracket is tight.
5. Loosen socketed head cap screw.
6. Adjust the index transducer's position until the transducer's tip touches the hub and points straight at the center of the spindle.
7. Reinstall the cartridge, set RUN switch and return to step B above.

## 6-5. COARSE RADIAL ALIGNMENT

### A. INITIAL READING

1. Select DSU FUNCTION 4.
2. Set toggle switch HEAD 1 and push START. Drive will seek to cyl. 0.
3. Short the "POS" signal to ground and slowly move heads until needle on DSU pegs to the left.
4. Disconnect ground short, servo will lock.
5. Note reading on the digital display.

### B. CORRECTED READING

1. Select DSU function 6 (seek to cyl. 410) and repeat step A. Be sure to note this second reading from the digital display also.
2. Now compute the true readings using the correction factors noted on the label of the servo cartridge. Use the following formula:

$$\text{TRUE} = \text{DIGITAL} - \text{CORRECTION}$$

#### EXAMPLE A

Digital = +2.1  
Correction = +.3  
True = (+2.1) - (+.3)  
True = +1.8

#### EXAMPLE B

Digital = +1.7  
Correction = -.4  
True = (+1.7) - (-.4)  
True = +2.1

### C. TORQUEDOWN

1. Torque the rear actuator mounting screws to 40 in. lbs.
2. Using the radial alignment tool, adjust the linear motor until the true reading from cylinder 410 is within 0.1 of the true reading from cylinder 0.
3. Now torque the rear mounting screws to the final torque of 80 in./lbs. and repeat steps A & B to verify the fixed position of the linear motor.

Table 6 – 1. Fixed Disc Installation Guide

<p><b>A. DISC INSTALLATION PREPARATION</b></p> <ol style="list-style-type: none"> <li>1. Clean spindle hub with sticky side of masking tape.</li> <li>2. Clean disc chamber and spindle hub (see note).</li> <li>3. Clean fixed disc cover and clamp ring (see note).</li> <li>4. Install dial indicator and support post.</li> <li>5. Put face mask on, then finger cots.</li> <li>6. Clean data surface (dark side)(see note).</li> </ol> <p><b>B. DISC INSTALLATION</b></p> <ol style="list-style-type: none"> <li>1. Place disc on hub (data surface down).</li> <li>2. Position clamp ring and screws (finger tight).</li> <li>3. Perform runout adjustment (2 major divisions).</li> <li>4. Torque screws to 8 inch/pounds (star pattern).</li> <li>5. Re-check runout.</li> <li>6. Perform flatness check (4 major divisions).</li> <li>7. Install index transducer.</li> <li>8. Clean servo surface (see note).</li> <li>9. Install fixed disc cover.</li> </ol> <p><b>C. SERVO FORMAT PREPARATION</b></p> <ol style="list-style-type: none"> <li>1. Perform index transducer pre-alignment.</li> <li>2. Degauss fixed disc.</li> <li>3. Replace receiver and related items.</li> <li>4. Remove A2, A5 and A6 PCA's.</li> <li>5. Remove data head 0, replace with a servo head.</li> <li>6. Install head alignment preamp.</li> <li>7. Install servo formatting PCA (A5 slot).</li> <li>8. Connect servo head cables to formatter.</li> <li>9. Install servo reference cartridge.</li> <li>10. Warm up for 20 minutes.</li> <li>11. Turn off all equipment in rack.</li> <li>12. Ensure stability of disc drive.</li> </ol>	<p><b>D. SERVO FORMAT AND VERIFICATION</b></p> <ol style="list-style-type: none"> <li>1. Depress "START" pushbutton on formatter PCA.</li> <li>2. Wait for "COMPLETE" LED (8 minutes).</li> <li>3. Power down, remove servo formatter PCA.</li> <li>4. Re-install A5 and A2 PCA's.</li> <li>5. Install DSU and head alignment PCA.</li> <li>6. Connect head 0 to head alignment PCA.</li> <li>7. Connect servo head to A5 PCA.</li> <li>8. Spin-up, align head 0 (DSU function 7).</li> <li>9. Verify code (DSU function 2, switches S1 and VFY).</li> <li>10. After one complete pass, stop DSU.</li> </ol> <p><b>E. PREPARATION FOR ALIGNMENTS</b></p> <ol style="list-style-type: none"> <li>1. Re-install data head 0.</li> <li>2. Install head alignment cartridge.</li> <li>3. Random seek for 10 minutes (delay = 50 ms).</li> </ol> <p><b>F. ALIGNMENTS</b></p> <ol style="list-style-type: none"> <li>1. Pre-align heads 0, 1 (<math>\pm 30</math>).</li> <li>2. Seek time.</li> <li>3. Radial.</li> <li>4. Index transducer.</li> <li>5. Final head alignment.</li> </ol>				
<p><b>Note: Use only approved cleaning materials:</b></p> <table> <tr> <td>Isopropyl alcohol</td> <td>8500-0559</td> </tr> <tr> <td>Cleaning wipes</td> <td>9310-4865</td> </tr> </table>		Isopropyl alcohol	8500-0559	Cleaning wipes	9310-4865
Isopropyl alcohol	8500-0559				
Cleaning wipes	9310-4865				

# PERIPHERALS

SECTION

VII

THIS SECTION WILL CONTAIN HOST (AS OPPOSED TO PERIPHERAL)  
INFORMATION AS IT BECOMES AVAILABLE---CONTRIBUTIONS WELCOMED.

# REPLACEABLE PARTS

SECTION

VIII

## 8-1. COMMON REPLACEABLE PARTS

### FILTERS

Prefilter	3150-0329
Absolute	3150-0276

### LAMPS

2140-0537

### FUSES

refer to Table 2-2 & 2-3

### SWITCHES

Door locked	3102-0009
Door closed	3102-0009
Cartridge-in-place	3102-0009
Unit select	3100-1700

### HEADS

Up	07905-60024
Down	07905-60025
Servo	07905-60026

### MEDIA

Data cartridge	12940A
Fixed disc	07906-60009

### MISCELLANEOUS

Velocity transducer	07906-60046
Carriage solenoid	07906-60088
Carriage back detect	1990-0467
Door lock solenoid	07905-60058

CABLES refer to table 2-1

NOTE: For a complete listing of all field replaceable components, refer to 7906 Service Manual, section III, Replaceable Parts.

## 8-2. PCA HISTORY

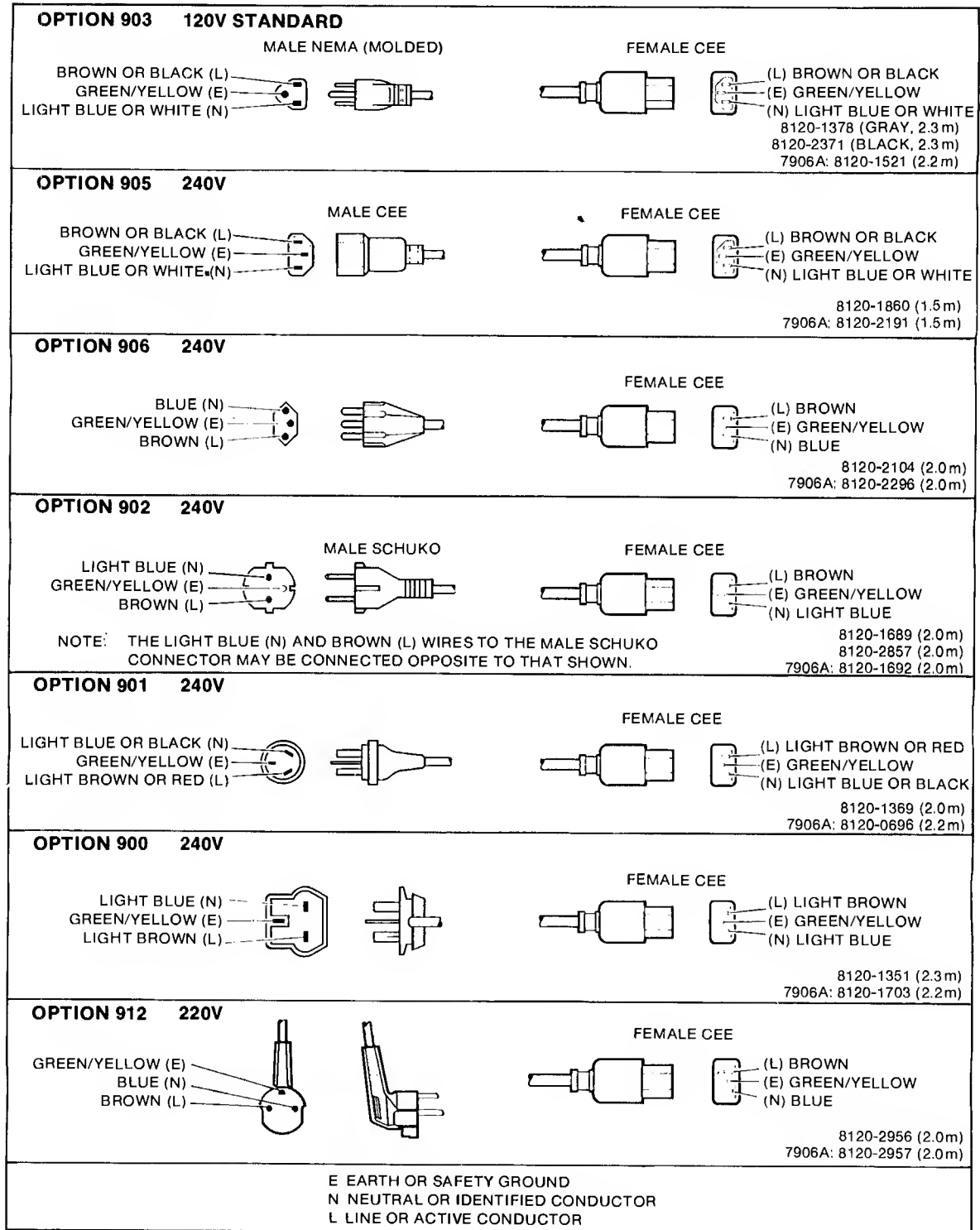
	<u>ASSEMBLY</u>		<u>EXCHANGE</u>	<u>CONSUMABLE</u>
A2	I/O SECTOR PCA	07906-60001	X	
A3	SERVO PCA	07906-60003	X	
A4	CONTROL PCA	07906-60102	X	
A5	TRACK FOLLOWER	07906-60004	X	
A6	R/W PREAMP PCA	07906-60006	X	
A7	MOTHERBOARD PCA	07906-60108		X
A8	POWER & MOTOR CONTROL (PMR)	07906-60095	X	
A9	INDICATOR PCA	07906-60011		X
A10	ENCODER PCA	07920-60009		X



# DIAGRAMS

SECTION

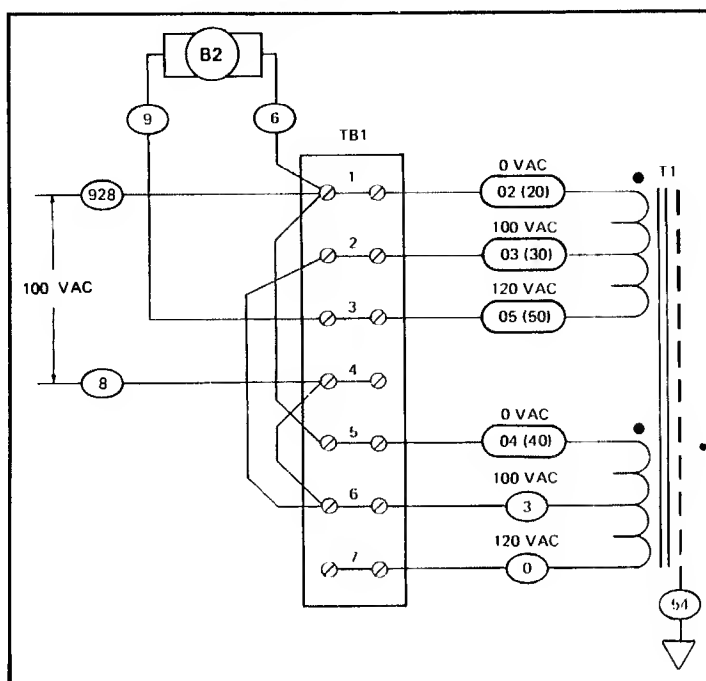
IX



REF 7311-1D

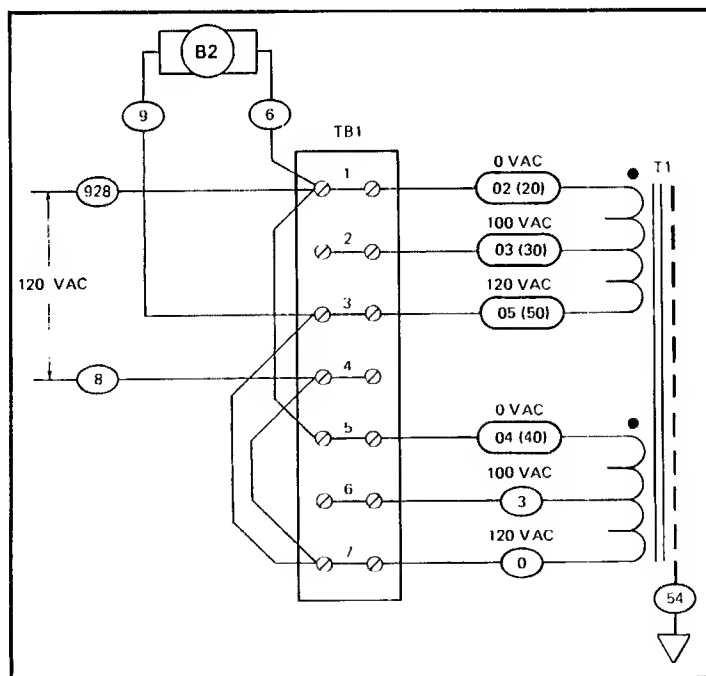
Figure 9-1. Power Cord Options

### 100 VAC STRAPPING



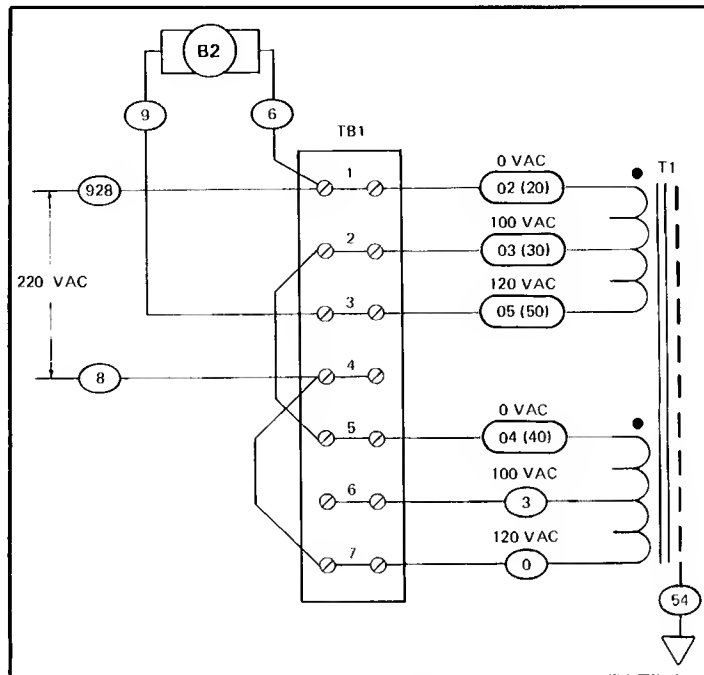
NOTE FOR 7906H: REAR COVER FAN (B4)  
CONNECTS TO TERMINALS 5 AND 7.

### 120 VAC STRAPPING



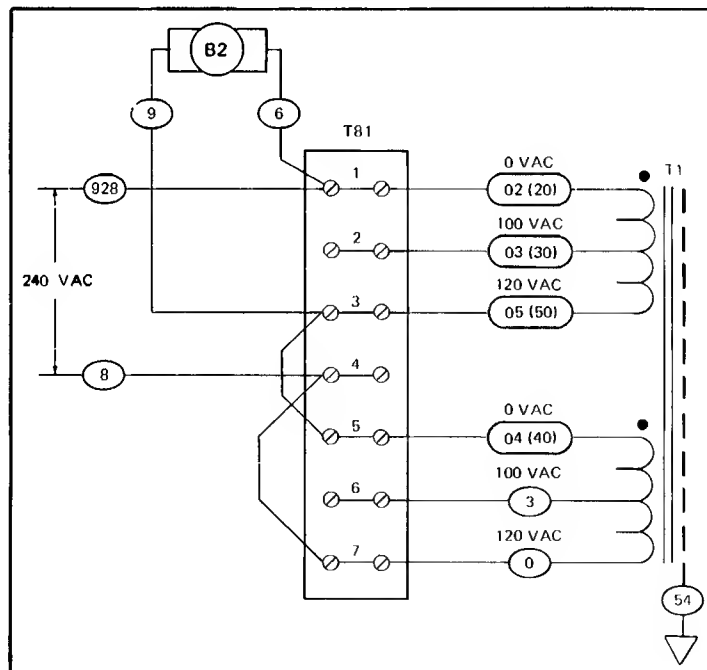
NOTE FOR 7906H: REAR COVER FAN (B4)  
CONNECTS TO TERMINALS 5 AND 7.

### 220 VAC STRAPPING



NOTE FOR 7906H: REAR COVER FAN (B4)  
CONNECTS TO TERMINALS 5 AND 7.

### 240 VAC STRAPPING



NOTE FOR 7906H: REAR COVER FAN (B4)  
CONNECTS TO TERMINALS 5 AND 7.

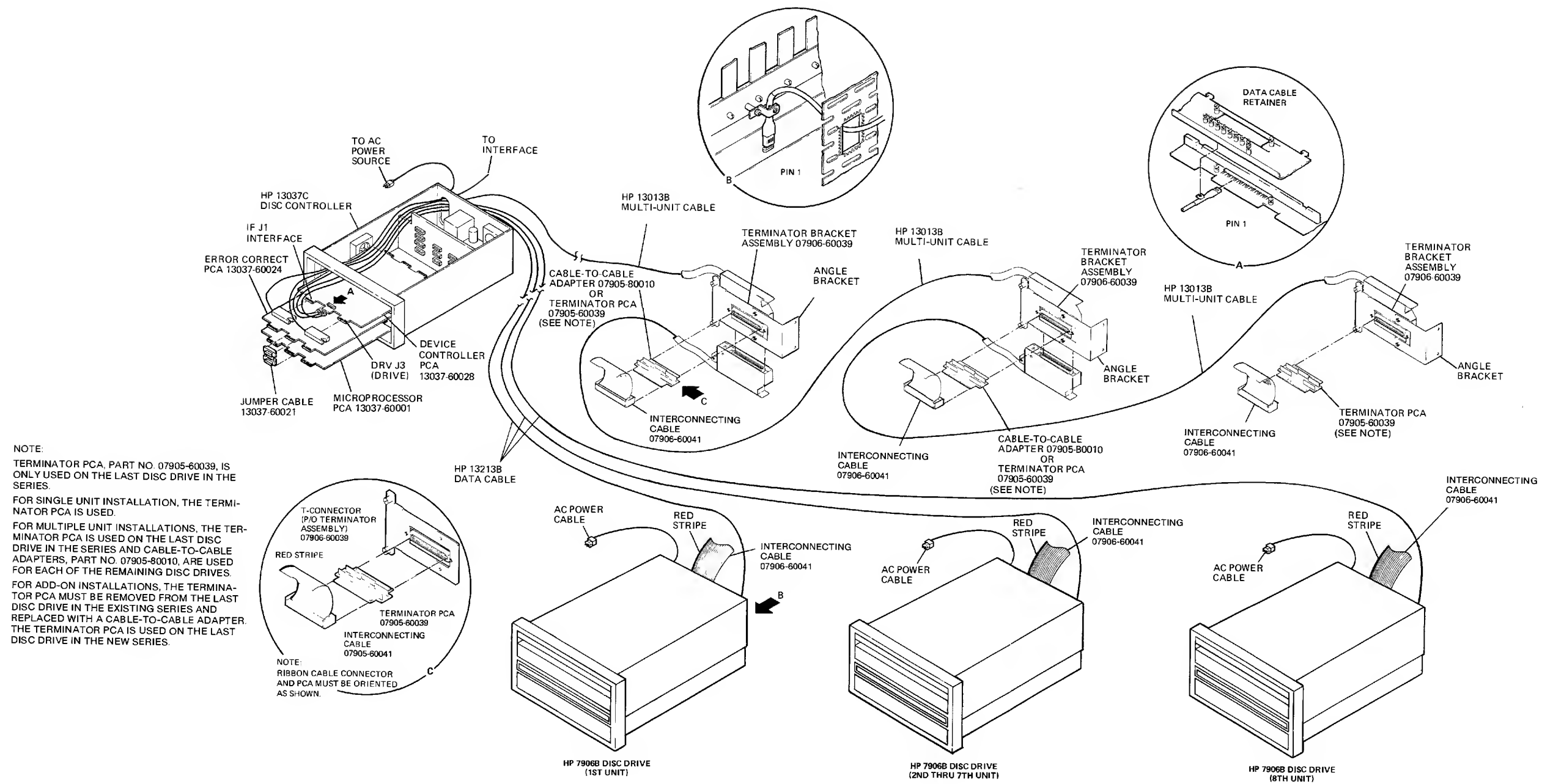


Figure 9-4. HP 7906 "B" Model Interconnection Diagram

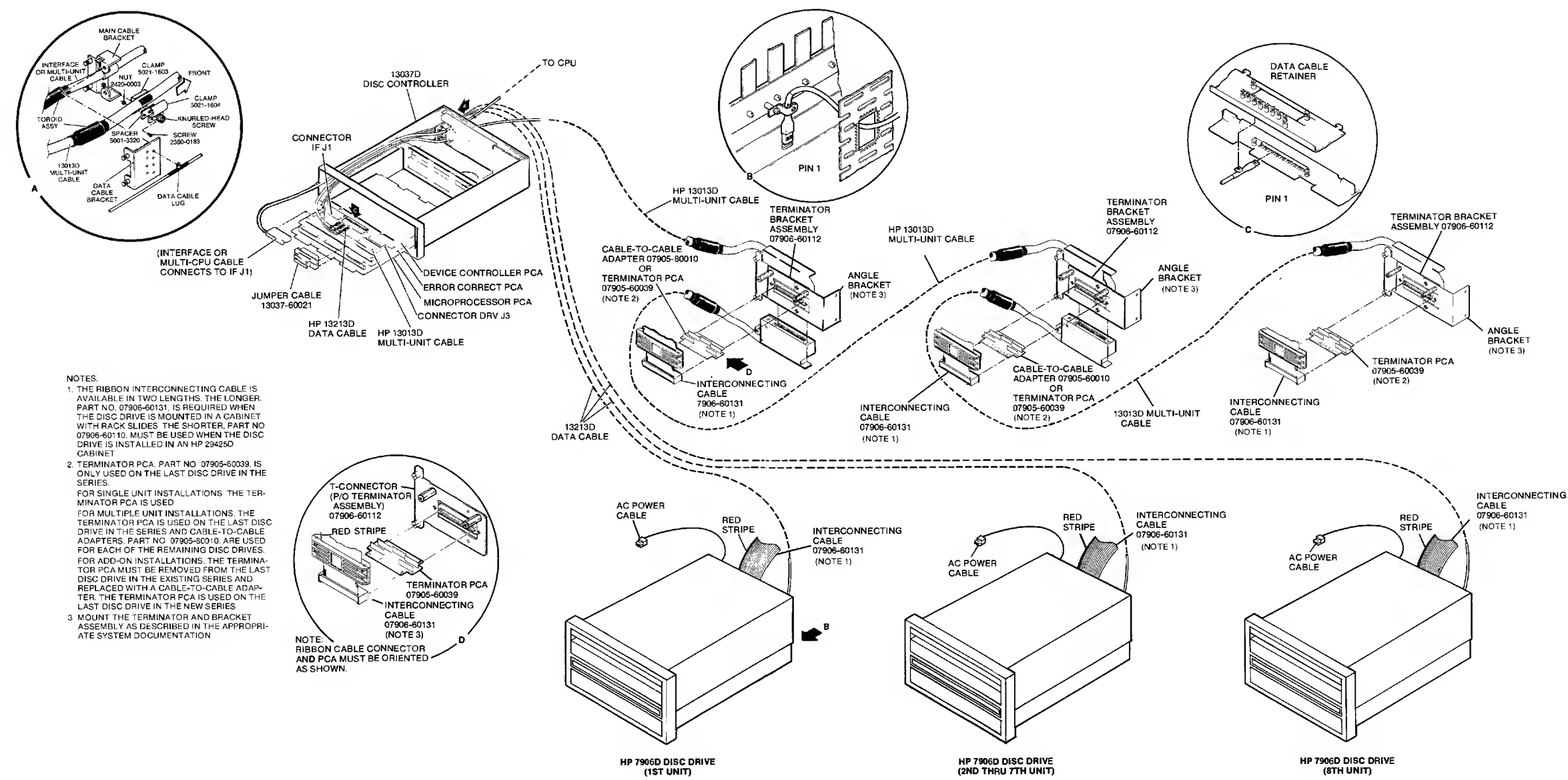


Figure 9-5. HP 7906 "D" Model Interconnection Diagram

**REFERENCE****SECTION****X****10-1. MNEMONICS & ABBREVIATIONS**

MNEMONIC	NAME	MNEMONIC	NAME
ACRY	Access Ready	NDWF	Nondestructive Wr. Fault
ACW	AC Write Current	NLD	Negative Level Detector
ADDR	Address	O/S	Offset
ADR	Address Record	OSD	Offset Settling Delay
ADU	Address Unit	POR	Power-On Reset
AGC	Automatic Gain Control	POS	Position
AGCF	AGC Fault	PRT	Protect
AT	Attention (test point)	PRTL	Protect Lower Disc
ATTN	Attention	PRTU	Protect Upper Disc
ATTI	Attention 1	R	Reset
B0-B10	Control Bus 0-10	RBR	Run Brushes
CC	Current Command	RCL	Recalibrate
CIP	Cartridge-In-Place	RDA	Read Data A
CLA	Clear Attention	RDB	Read Data B
CLK	Clock	READ	Read
CLO	Clear Offset	REF	Reference
CLR	Clear	RET	Retract
CLS	Clear Status	REV	Reverse
CPS	Controller Preset	RH	Restore Home
CRB	Carriage Back	RPS	Rotational Position Sensing
CSOL	Carriage Solenoid	RQA	Request Attention
CYL	Cylinder	RQP	Request Position (sector)
DCN	Disconnect	RQS	Request Status
DCW	DC Write Current	RS	Run Spindle
ddb	Differential Data Buffered	S	Set
DGC	Data AGC	SB	Servo Balanced
DIFF	Difference	SC	Sector Compare
DL	Door Locked	SCL	Sector Clock
DPS	Destructive Preset	SEL	Select
DRDY	Drive Ready	SEN	Servo Enable
DRDYL	Drive Ready Lamp	SK	Seek
DWA	Decrease Wr. Current (13 ma)	SKC	Seek Complete
DWB	Decrease Wr. Current (6.5 ma)	SKH	Seek Home
DWC	Decrease Wr. Current (3.25 ma)	SKI	Seek Inhibit
D0-D10	Control Bus 0-10 Buffered	SL	Drive Selected by Controller
DWF	Destructive Write Fault	SMC 1,2	Spindle Motor Current
ECS	Energize Carriage Solenoid	SOF	Set Offset
EIA	Enable Illegal Address	SPD	Spindle Speed Down
ENA	Encoder Phase A	SPU	Spindle Speed Up
ENB	Encoder Phase B	STB	Strobe
FLT	Fault	STP	Set Timeout Period
FTL	Fault Lamp	SW	Switch
FMT	Format	TAC	Tachometer
FWD	Forward	TCD	Track Centered
GATEDAT	Gated Attention	TEMP	Temperature
HLDD	Heads Loaded	TO	Timeout
HS0	Head 0 Selected	TTO	Temperature Timeout
HS1	Head 1 Selected	T0-T3	Tag Bus 0-3
HS2	Head 2 Selected	UDS	Upper Disc Selected
ICA	Illegal Cylinder Address	UIX	Upper Index
ILF	Interlock Fault	UP	Upper Pulse
LD	Lock Door	URG	Unselected Read Gate
LIP	Lower Index Pulse	USS	Upper Surface Selected
LP	Lower Pulse	UWG	Unselected Write Gate
LSB	Least Significant Bit	USO 0-2	Unit Select 0, 1, 2
M	Match	WDA	Write Data A
M-1	Match Minus One	WDB	Write Data B
MH	Multiple Heads	WEN	Write Enable
MHS	Multiple Heads Selected	WRITE	Write
NDPS	Nondestructive Preset	XMS	Transmit Sector
		ZCR	Zero Crossing

## 10-2. PCA INPUT/OUTPUT SIGNALS

### A2 I/O SECTOR

#### INPUTS

B0-B10  
ACRY        FLT  
STB        DRDY  
T0-T3       FMT  
CYL        ICA  
OSD        ATT1  
LIP  
SCL  
PRTL/PRTU  
NDPS  
US0-US2  
UIX

#### OUTPUTS

D0-D9  
PRT  
CPS  
SOF  
RH  
SK  
CLA  
UWG/URG  
UP  
USS  
UDS  
SEL

### A3 SERVO

#### INPUTS

SKH/SK  
TAC  
RET  
AGC  
POS  
OSD  
D0-D8  
EIA  
SKI

#### OUTPUTS

AGCF  
CLO  
LSB  
M  
CC  
SB  
DWA/DWB/DWC  
CYL  
ICA

### A4 CONTROL

#### INPUTS

CIP.DL  
CLA        URG/UWG  
CRB        SEL  
SB        PRT  
TTO        USS/UDS  
SOF        ACRY  
AGC/AGCF   ACW/DCW  
SPU        MHS  
STOP       DPS/NDPS  
RUN        DRDY  
SPD        DWF/NDWF  
CPS        RDA/RDB  
STP  
RET  
SK  
SEN  
RH  
CYL

#### OUTPUTS

LD  
DPS/NDPS  
FLT/FLTL  
DRDYL  
RBR  
RET  
ILF  
ECS  
ATT1  
ACRY  
RS  
HS0-HS2  
WEN  
SKH  
DDB  
WDA/WDB  
DRDY  
Fault LED's

## A5 TRACK FOLLOWER

### INPUTS

Servo code  
LSB  
D0-D5,D7  
SOF  
DWA/DWB  
CLO  
SPU  
M  
USS/UDS  
ACRY  
Temp.comp.  
Drive type

### OUTPUTS

SCL  
POS  
AGC  
LIP  
OSD  
TTO

## A6 R/W PREAMP

### INPUTS

DGC  
HS0-HS2  
WDA/WDB  
WEN  
DWA/DWB/DWC

### OUTPUTS

RDA/RDB  
MHS  
ACW  
DCW

## A8 PMR

### INPUTS

CRB  
ENA/ENB  
RS  
DPS  
ILF  
SEN  
CC  
LD  
RBR  
ECS  
CRB

### OUTPUTS

SMC 1/SMC 2  
STP/180 Hz  
CSOL  
SPU/SPD  
LD  
LMC/LMV  
+5V  
+12V  
-12V  
-24V  
+10V  
25 VAC



# SERVICE NOTES

SECTION

XI

Table 11-1. Service Note Summary

DATE	TITLE	SERVICE NOTE NUMBERS					
		M	MR	S	SR	H	HR
3'79	NEW TRANSFORMER ASSY.	M-01		S-01			
8'79	DATA ERRORS/13213B						-01
9'79	COIL OSCILLATION	M-01	MR-01	S-01	SR-01		
10'79	WIRING REVERSAL	M-02	MR-02	S-02	SR-02		
4'80	DEFECTIVE POWER SWITCHES	M-03	MR-03	S-03	SR-01		
7'80	DEFECTIVE TRANSFORMERS	M-04	MR-04	S-04	SR-02	H-01	HR-01
11'80	NEW DRIVE CONTROL PCA	M-05	MR-05	S-05	SR-03	H-02	HR-02
6'83	FIXED DISC BRUSH REMOVAL	M-05A	MR-05A	S-05A	SR-03A	H-02A	HR-02A
11'80	DATA ERRORS ON ICD DISC					H-03	HR-03
5'81	MOTHERBOARD CHANGE					H-04	HR-04
5'81	TEMPERATURE SENSOR ASSY.	M-06	MR-06	S-06	SR-04	H-05	HR-05
12'81	IMPROPERLY GROUNDED FANS	M-07		S-07		H-06	
4'82	IMPROPERLY GROUNDED FANS	M-07A		S-07A		H-06A	
1'82	DATA BOARD FAILURES					H-07	HR-06
3'82	NEW BLOWER MOTOR	M-08	MR-07	S-08	SR-05	H-08	HR-07
10'82	MISLOADED CAPACITOR	M-08	MR-09				
4'83	POWER CONTROL ASSY.		MR-10		SR-06		HR-08
8'83	NEW UNIT SELECT SWITCH	M-09	MR-10	S-09	SR-07	H-09	HR-09
1'84	PDU FAN REVERSAL	M-10					
<p>Note 1: On the occasions when duplicate numbers were erroneously assigned, reference the date and title to differentiate the notes.</p> <p>Note 2: Number MR-08 was never assigned.</p>							



This section contains information unique to "H" model drives.

The information supplements the previous handbook sections as follows.

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Figure A-1.	HP 7906H Overall Block Diagram
Figure A-2.	HP-IB Interconnection Details
Figure A-3.	HP-IB Connector Pin Assignments
Figure A-4.	Microprocessor Programming Jumpers (PCA-A2)
Figure A-5.	Rear Panel Self-Test Controls & Indicators
Table A-1.	Self-Test Operations
Table A-2.	Self-Test Description
Table A-3.	Test Failure Summary

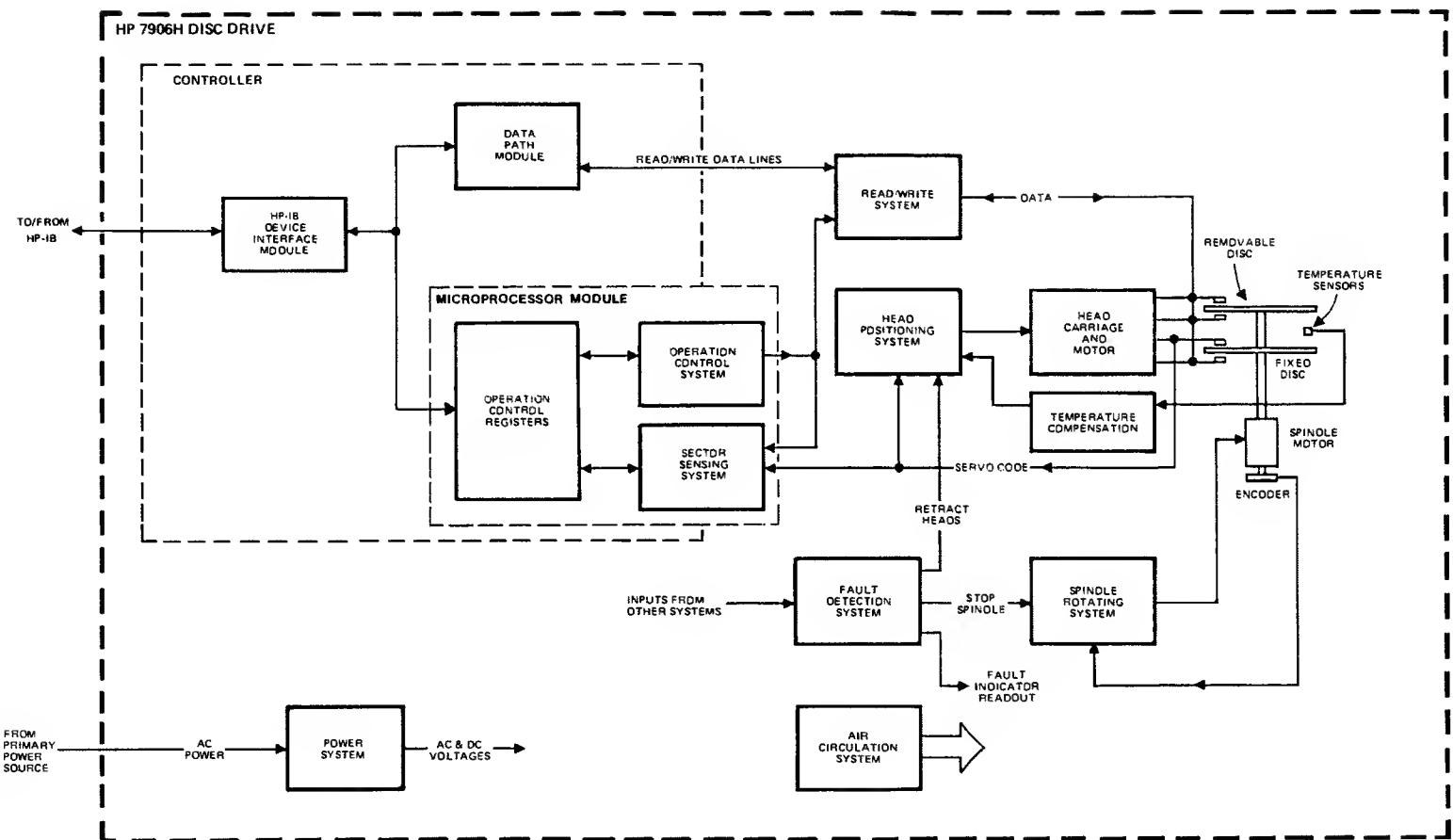
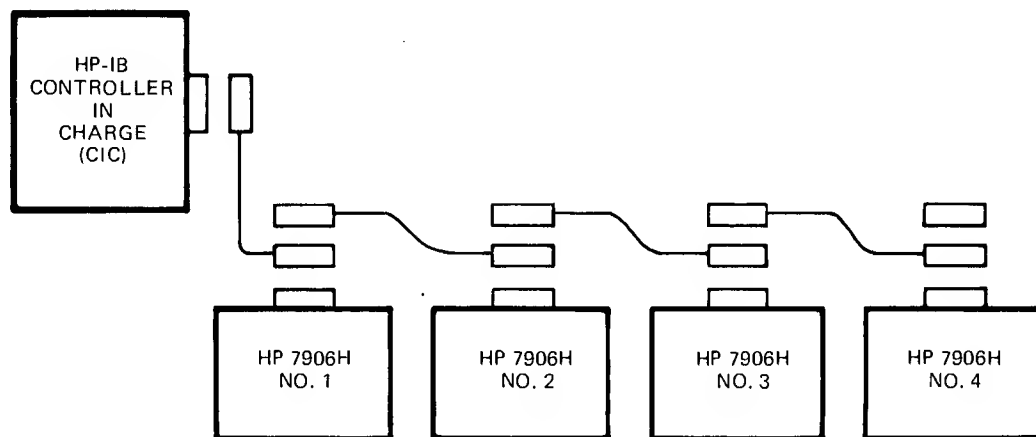
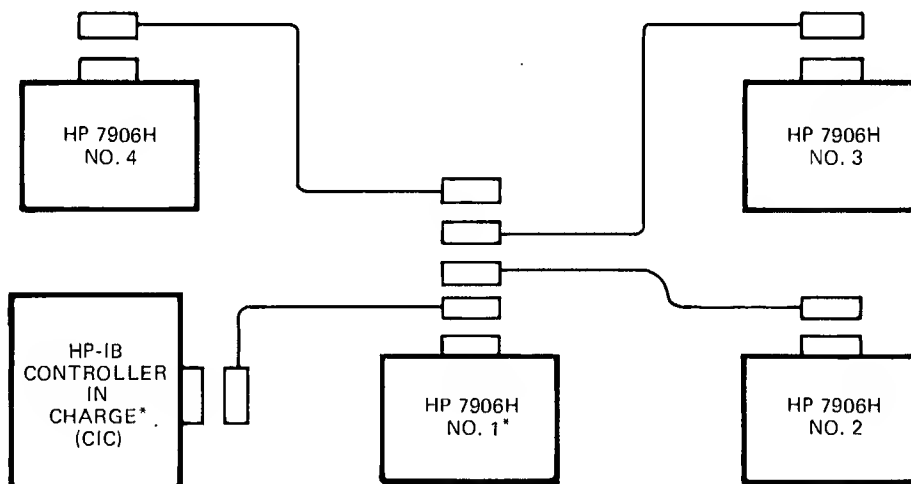


Figure A-1. HP 7906H Overall Block Diagram



a. Linear Configuration

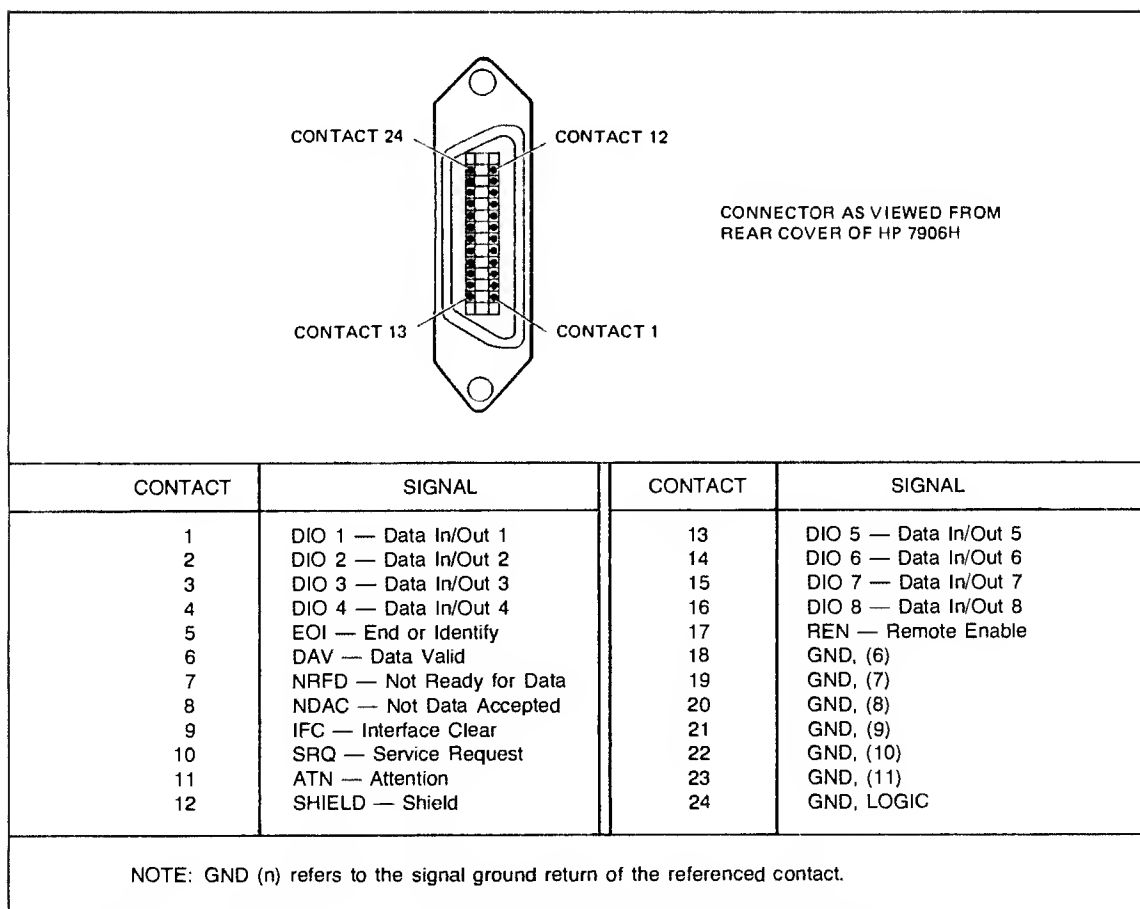


\* Can be interchanged

b. "Star" Configuration

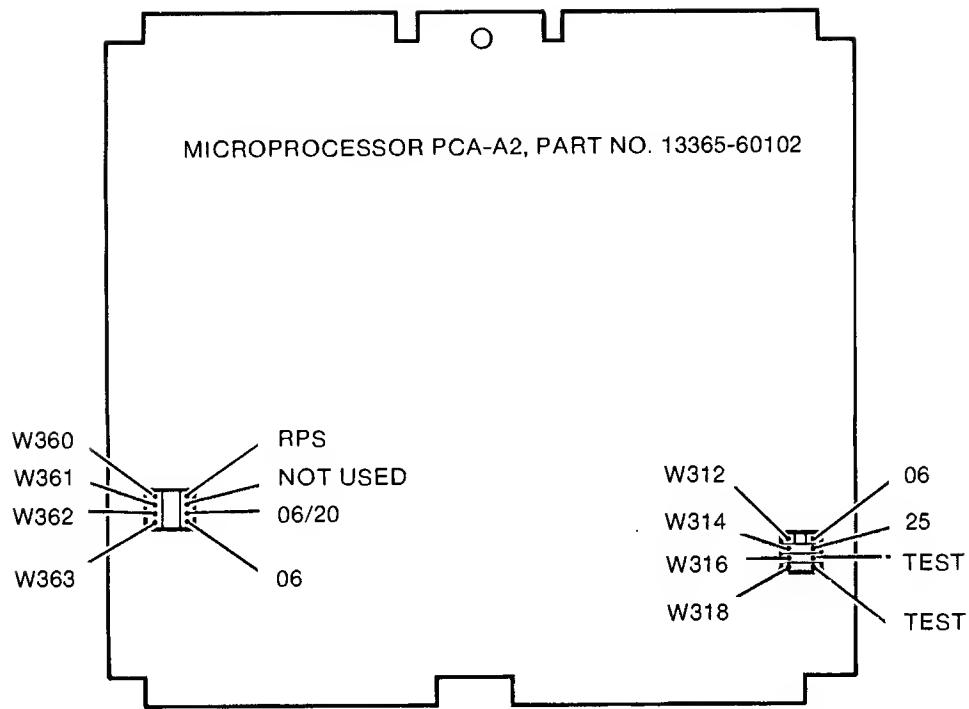
NOTES:

1. All interconnecting cables are HP-IB interface cable assemblies, model no. 10833B. The length of this cable is 2 metres (6.55 feet).
2. Observe the cabling length restrictions detailed in paragraph A-7 and listed on the "HP-IB Configuration Restriction" labels attached to the equipment.
3. Four HP 7906H's (maximum) are allowed on one HP-IB channel.



REF 7300-116

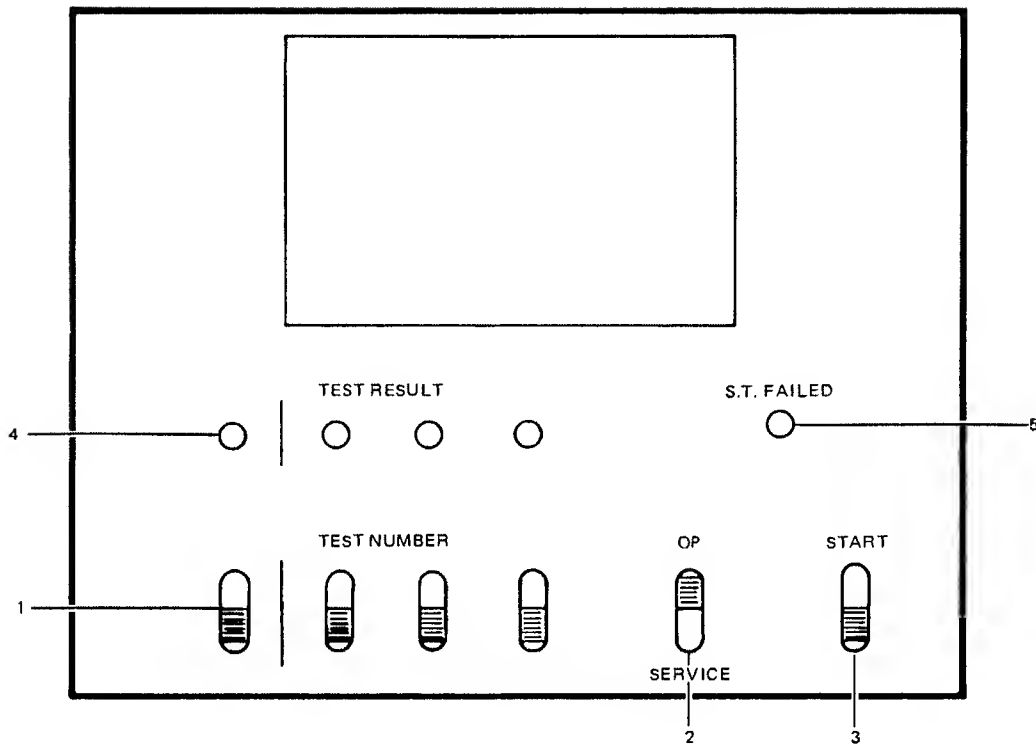
**Figure A-3. HP-IB Connector Pin Assignments**



JUMPER	FUNCTION	JUMPER	FUNCTION
W360	Not used.	W312	Sector circuit configuration. Jumper should be in place for HP 7906H.
W361	Not used. A spare jumper can be stored here.	W314	Sector circuit configuration. Jumper should <i>not</i> be in place for HP 7906H.
W362	Drive type selection. Jumper should be in place for HP 7906H.	W316	For test purposes only. Jumper should always be in place for normal operation.
W363	Drive type selection. Jumper should be in place for HP 7906H.	W318	Same as W316.

REF 7300-118

Figure A - 4. Microprocessor Programming Jumpers (PCA -A 2)



- |                         |  |
|-------------------------|--|
| 1. TEST NUMBER switches | — Select desired self-test test number in octal when OP/SERVICE switch (2) is in SERVICE position.   |
| 2. OP/SERVICE switch    | — Selects self-test mode of operation. When OP position is selected, controller executes self-test routine at power turn-on, on HP-IB command, or when START switch (3) is activated. Switch must be in OP position for disc drive to operate normally. When SERVICE position is selected, controller will loop continuously in self test until a fault is detected. |
| 3. START switch         | — Initiates self-test operation. Switch is spring-loaded in off position.  |
| 4. TEST RESULT LED's    | — Provides a readout of self-test operation. At beginning of self-test routine, LED's will flash briefly, indicating controller activity and testing of LED's. If a test fails, the LED's indicate the number of the failed test in octal. If self test passes, the LED's remain unlit.  |
| 5. S.T. FAILED LED      | — Indicates a self-test (S.T.) failure. Result is duplicated by SELF TEST FAILED indicator on disc drive operator panel.   |

REF 7300-99

**Figure A - 5. Rear Panel Self-Test Controls & Indicators**



**Table A – 1. Self-Test Operations**

<b>SWITCH SETTING</b>	<b>SELF-TEST ACTION</b>	<b>LED DISPLAY</b>
OP/SERVICE switch: OP TEST NUMBER switches: Any setting START switch: Momentary operation	Tries to execute all tests once. If error in test 17, 16, or 15, controller hangs <sup>1</sup> . If error in tests 14 through 1, exits immediately to controller firmware.	All LED's flash momentarily. If there is an error, TEST RESULT LED's display failed test number. S.T. FAILED LED is also lit. If there is no error, all LED's go off.
OP/SERVICE switch: OP TEST NUMBER switches: Any setting START switch: Held in on position <sup>2</sup>	Loops on entire self test until START switch is released. Exits test only when switch is released. Executes tests up to first error and then restarts self test.	All LED's flash momentarily each pass through self test. Error is not displayed until START switch is released.
OP/SERVICE switch: SERVICE <sup>3</sup> TEST NUMBER switches: n = 2 START switch Momentary operation	Loops on test n until first error is detected. Halts (JMP*) on error until START switch is set again (except for error in test 17, where controller hangs).	TEST RESULT LED's flash test n each time that test is completed. On error in test n, LED's continuously display section number of failure. S.T. FAILED LED is also lit.
OP/SERVICE switch: SERVICE <sup>3</sup> TEST NUMBER switches: 2 START switch: Momentary operation	Generates PHI tuning procedure.	Flashes 2 on TEST RESULT LED's.
OP/SERVICE switch: SERVICE <sup>3</sup> TEST NUMBER switches: 1 START switch: Momentary operation	Causes disc drive to do random seeks.	Flashes 1 on TEST RESULT LED's.
OP/SERVICE switch: SERVICE <sup>3</sup> TEST NUMBER switches: 0 START switch: Momentary operation	Loops on entire self test until error is detected. Halts on error until START switch is set again (except for errors in test 17, where controller hangs).	TEST RESULT LED's flash test number each time test is completed. On error in a test, LED's continuously display failed test number. S.T. FAILED LED is also lit.
<p>Notes:</p> <ol style="list-style-type: none"> <li>1. An error in test 17, 16, or 15 will cause the controller to hang (i.e., not respond to HP-IB commands). The only way to reset the controller after a test 17 failure is to reset the disc drive, either by cycling the disc drive power switch or the RUN/STOP switch. In tests 16 and 15, activating the START switch also restarts self test.</li> <li>2. In the service mode, with the START switch held in the on position, the controller will loop on the appropriate test (or entire self test) until the first error is detected, when it will start over again. The START switch inhibits error halts except in test 17.</li> <li>3. Always return the OP/SERVICE switch to the OP position to use the disc drive. Otherwise, the controller will not respond to HP-IB commands.</li> </ol>		

**Table A - 2. Self-Test Description**

TEST NO.	TEST	DESCRIPTION
17	Microprocessor alive	This is the first test executed. It tests the heart of the microprocessor — the sequencers and the branching logic. Some ALU faults are also trapped by test 17. If a fault is detected in test 17, the controller hangs up in a JMP* loop. The only way to exit this loop is to either cycle the POWER switch or the disc drive RUN/STOP switch. This action resets the microprocessor and causes it to start self test over. There are no distinct sections within this test. On error, the TEST RESULT LED's display an octal 17 both in the OP (operating) and SERVICE positions of the OP/SERVICE switch.
16	RALU, Flags	This test checks the 2901 registers and arithmetic/logic units (RALU's), and the program status register flags. Like test 17, if a failure is detected in test 16, the controller hangs. Unlike test 17, the "hang" loop can be exited by activating the START switch. On error, the TEST RESULT LED's display an octal 16 continuously whether in the OP or SERVICE mode (unless the START switch is held in the on position).
15	PHI	This test checks the PHI in its offline mode. The following items are tested: <ul style="list-style-type: none"> <li>• PHI identity sequence</li> <li>• PHI interrupt flags</li> <li>• Inbound and outbound FIFO data test</li> <li>• Data tag bits (EOI and ATN)</li> </ul> On error, test 15 outputs an octal 15 on the TEST RESULT LED's and hangs the controller, whether in the OP or SERVICE mode. The hang condition can be exited by activating the START switch.
14	FIFO's	This test checks the 9403 FIFO's in the controller. The following possible faults are tested: <ul style="list-style-type: none"> <li>• NTORE stuck at 0 or 1 faults</li> <li>• Data errors within each FIFO</li> </ul> At this point, the microprocessor and PHI are assumed good and errors can be reliably reported via the HP-IB. This is the first test that a) reports section numbers, and b) exits to the controller operating firmware after an error is detected. Even if test 14 fails, the controller attempts to execute commands and secondaries. Any operation involving data transfer through the FIFO's will probably fail.
13	PHI/FIFO handshake	This test checks the PHI/FIFO handshake logic, sector word counters, read full/write full flip-flop, and EOT detector. The test transfers data from the FIFO, through the PHI, and back to the FIFO. The PHI is in its offline loopback mode.
12	Formatter/ Separator Loopback Test	This test checks the formatter/separator, serial operation of the FIFO's (both in and out), the overrun detector, and the EOW/8th word counter. The test is divided into three subtests: <ol style="list-style-type: none"> <li>a. The formatter/separator itself is first tested by passing a known data pattern from the FIFO through the formatter/separator in its loopback mode and back into the FIFO. The received data pattern is then compared with the original.</li> <li>b. The overrun detector is then checked by clearing the FIFO and enabling the formatter/separator. An overrun will result when the formatter/separator tries to pull data from an empty FIFO.</li> <li>c. Finally, the 8th word counter is tested by passing 16 bytes through the formatter/separator, counting EOW's, and seeing that the 8th word flag is set only after the 16th byte (8th word) is transferred.</li> </ol>

**Table A - 2. Self-Test Description (cont'd)**

TEST NO.	TEST	DESCRIPTION
11	CRC/Data Path Switch	This test checks the CRC generator/checker (9401) and the data path switch (CRC multiplexer). It checks that the CRC chip generates the proper CRC pattern and properly detects CRC errors. A known pattern is loaded into the FIFO, sent through the CRC chip, and returned through the formatter/separator to the FIFO. The generated CRC pattern is then switched into the data path and loaded into the FIFO, where it is checked against the expected results. The ANYER (CRC error) flag is also checked as data is shifted through the CRC chip.
10	Drive Status	This test looks at the drive status register and reports an error if the disc drive is busy with drive ready set or if the drive is faulted. Self test will loop on Tests 17 through 10 until Drive Ready becomes active, flashing octal 10 every time test 10 is executed. When Drive Ready becomes active, the remaining tests will be executed. If Drive Ready does not become true before 92 seconds have elapsed, the S.T. FAILED LED will light and the TEST RESULT LED's will display octal 10. Note: If the disc drive is powered on and the RUN/STOP switch is not in the RUN position or the disc pack is not in place, the resulting absence of Drive Ready will cause the S.T. FAILED indicator to come on approximately 92 seconds after power on is initiated. If this occurs, proper preparation of the disc drive for operation (disc pack installed and RUN/STOP switch set to RUN) will allow the self-test routine to start again.
7	Head/Sector Logic	This test checks much of the I/O sector logic of the controller. The head register is first tested for stuck-at faults. Disallowing drive types (set via the drive type jumpers) will also be reported as an error. The index counters, sector counters, sector comparators, sector registers, and sector compare flip-flop are also tested here. This section of the test is executed twice, once with head 1 addressed and once with head 2 addressed. This tests both sets of sector counters if the drive type is set to a 7906.
6	Recalibrate Test	This test issues a RECALIBRATE command to the drive, waits for drive attention (with a time limit of 1275 milliseconds), and checks the resulting drive status. If the recalibrate does not complete in time, a timeout error is reported. If an attention is received in time, the drive status is then checked; bad drive status is reported to the TEST RESULT LED's.
5	Seek Test	This test exercises the seek function of the disc drive by issuing a seek to the maximum cylinder address. If the seek completes within 100 milliseconds, the controller issues a seek to the maximum cylinder address + 1, forcing a seek check. If a seek check does in fact occur, the controller then issues a seek to cylinder 0, again with a 100 millisecond timeout. No address verification is done in this test, but if the drive does not end up on cylinder 0, the verify test which follows will fail.
4	Set Offset Test	The purpose of this test is to see if a set offset drive order to the disc drive will complete. The maximum positive offset (+63), maximum negative offset (-63), and zero offset are sent to the disc drive in that order. If attention is not received within 10 milliseconds, a timeout error is reported. This test does not verify that the heads are actually offset the proper direction and magnitude.
3	Verify Cylinder 0	This test attempts to verify cylinder 0 with no head offset. The purpose of this test is to check the read data path from the heads, through the preamp, and to the data separator. This test also verifies that the heads are on cylinder 0 by checking the address field in a sector. The entire cylinder is verified in cylinder mode with track sparing enabled. If a data error is found in any sector, one retry is attempted. If the retry also results in a data error, the test is aborted, and the failure is reported to the test panel LED's. No limit is placed on the number of retries allowed for the entire cylinder. Test 3 can fail due to several non-hardware related problems. Bad media, a track flagged defective but not properly spared, or a spare track in cylinder 0 will cause a test 3 failure. However, the drive can still be used after a test 3 failure.

**Table A – 2. Self – Test Description (cont'd)**

TEST NO.	TEST	DESCRIPTION
2	PHI Tuning Procedure	This test is not a legitimate part of the self-test routine. It is provided for diagnostic and service purposes. When selected, self test loops through the program steps described in the PHI data sheet. The HSE waveform can be measured and the delay stabilization trimmer adjusted.
1	Drive Random Seek Procedure	This test is not a legitimate part of the self-test routine. It is provided for diagnostic and service purposes. When selected, self test will generate seek commands using a pseudo-random number generator.

Table A-3. Test Failure Summary

TEST NO.	SECTION NO.	TEST RESULT LED'S	TEST/SECTION FAILURE	PROBABLE SOURCE
17	—	● ● ● ●	MICROPROCESSOR	PCA-A2*, disc drive
16	—	● ● ● ○	RALU, FLAGS	PCA-A2
15	—	● ● ○ ●	PHI	PCA-A1*, PCA-A2
14	17 16 15 14	● ● ○ ○ ● ● ● ● ● ● ● ○ ● ● ○ ● ● ● ○ ○	FIFO's NTORE stuck-at-0. NTORE stuck-at-1. Upper FIFO data error. Lower FIFO data error.	PCA-A1*, PCA-A2 PCA-A1*, PCA-A2 PCA-A1*, PCA-A2 PCA-A1 PCA-A1
13	17 16 15  14  13 12 11	● ○ ● ● ● ● ● ● ● ● ● ○ ● ● ○ ●  ● ● ○ ○  ● ○ ● ● ● ○ ● ○ ● ○ ○ ●	PHI/FIFO HANDSHAKE EOT flag stuck. Write-to-PHI not complete. Sector word counter does not handshake. Read full/write full does not override EOS (read from PHI handshake does not complete). EOT not detected. Lower NIBBLE data bad. Upper NIBBLE data bad.	PCA-A1 PCA-A1 PCA-A1 PCA-A1  PCA-A1  PCA-A1 PCA-A1 PCA-A1
12	17 16 15  14 13 12 11 10	● ○ ● ○ ● ● ● ● ● ● ● ○ ● ● ○ ●  ● ● ○ ○ ● ○ ● ● ● ○ ● ○ ● ○ ○ ● ● ○ ○ ○	FORMATTER/SEPARATOR EOW stuck true. No EOW in data test. Bad data from formatter/separator. Overrun stuck true. Undetected overrun. No EOW in 8th word test. 8th word flag stuck true. 8th word flag stuck false.	Data PCA-A1*, PCA-A2 PCA-A1 PCA-A1 PCA-A1  PCA-A1*, PCA-A2 PCA-A1*, PCA-A2 PCA-A1 PCA-A1*, PCA-A2 PCA-A1*, PCA-A2
11	17 16 15 14	● ○ ○ ● ● ● ● ● ● ● ● ○ ● ● ○ ○	CRC/DATA PATH SWITCH No EOW in test. CRC error stuck false. CRC error stuck true. Bad generated CRC pattern.	PCA-A1*, PCA-A2 PCA-A1 PCA-A1*, PCA-A2 PCA-A1*, PCA-A2 PCA-A1
10	17 16 10	● ○ ○ ○ ● ● ● ● ● ● ● ○ ● ○ ○ ○▲	DRIVE STATUS Drive fault. Drive busy while ready. Drive not ready.	Drive electronics*, PCA-A2 Drive electronics Drive electronics, PCA-A2 Drive electronics
○ = LED "OFF"      ● = LED "ON"      ▲ Display flashing      * Most probable source				

Table A - 3. Test Failure Summary (cont'd)

TEST NO.	SECTION NO.	TEST RESULT LED'S	TEST/SECTION FAILURE	PROBABLE SOURCE
7	17	○ ● ● ● ●	HEAD/SECTOR LOGIC	PCA-A2*, drive electronics
	16	● ● ● ● ●	Illegal drive type.	PCA-A2
	15	● ● ● ● ○	Bad head register.	PCA-A2
	14	● ● ○ ● ●	Sector count too large (head 1).	PCA-A2
	13	● ● ○ ○ ○	Sector count not incrementing (head 1).	PCA-A2*, drive electronics
	12	● ○ ● ● ●	Sector count not properly cleared (head 1).	PCA-A2*, drive electronics
	11	● ○ ● ● ●	Sector compare stuck-at-1 (head 1).	PCA-A2
	10	● ○ ○ ● ●	Sector compare stuck-at-0 (head 1).	PCA-A2
	7	● ○ ○ ○ ○	Sector compare set more than once per revolution (head 1).	PCA-A2
	6	○ ● ● ● ●	Sector count too large (head 2).	PCA-A2
	5	○ ● ● ● ○	Sector count not incrementing (head 2).	PCA-A2
	4	○ ● ○ ● ●	Sector count not properly cleared head 2).	PCA-A2*, drive electronics
	3	○ ● ○ ○ ○	Sector compare stuck-at-1 (head 2).	PCA-A2
	2	○ ○ ● ● ●	Sector compare stuck-at-0 (head 2).	PCA-A2
6	17	○ ○ ● ● ○	RECALIBRATE	Drive electronics*, PCA-A2
	16	● ● ● ● ●	Recalibrate timeout error.	Drive electronics*, PCA-A2
	4	○ ● ○ ○ ○	Attention stuck-at-1.	Drive electronics*, PCA-A2
	3	○ ○ ● ● ●	Drive busy and attention set.	Drive electronics*, PCA-A2
	2	○ ○ ○ ● ●	Drive not ready.	Drive electronics
	1	○ ○ ○ ○ ●	Seek check.	Drive electronics*, PCA-A2
5	17	○ ○ ● ● ○	Drive fault.	Drive electronics
	16	○ ○ ○ ○ ○	SEEK	Drive electronics*, PCA-A2
	15	● ● ● ● ○	Seek timeout error.	Disc drive*, PCA-A2
	4	● ● ● ● ○	Attention stuck-at-1.	Drive electronics
	3	● ● ○ ● ●	Undetected seek check.	Drive electronics*, PCA-A2
	2	○ ● ○ ○ ○	Drive busy and attention set.	Drive Electronics
4	17	○ ○ ● ● ●	Drive not ready.	Drive electronics
	16	○ ○ ○ ● ●	Seek check.	Drive electronics*, PCA-A2
	4	○ ○ ○ ○ ○	Drive fault.	Drive electronics
	3	○ ○ ○ ○ ○	SET OFFSET	Drive electronics*, PCA-A2
	2	○ ○ ○ ○ ○	Set offset timeout error.	Drive electronics*, PCA-A2
	1	○ ○ ○ ○ ○	Attention stuck-at-1.	Drive electronics
<p>○ = LED "OFF"      ● = LED "ON"      * Most probable source</p>				

Table A-3. Test Failure Summary (cont'd)

TEST NO.	SECTION NO.	TEST RESULT LED'S	TEST/SECTION FAILURE	PROBABLE SOURCE
3		○ ○ ● ●	VERIFY CYLINDER ZERO	Drive electronics* disc cartridge, PCA-A1
	17	● ● ● ●	Drive status error.	Drive electronics
	16	● ● ● ○	Address miscompare.	Drive electronics
	15	● ● ○ ●	Defective track error.	Disc cartridge
	14	● ● ○ ○	Direct access to spare track.	Disc cartridge
	13	● ○ ● ●	Head 10 data error.	Disc cartridge*, PCA-A6, PCA-A5
	12	● ○ ● ○	Head 9 data error.	Same as section 13
	11	● ○ ○ ●	Head 8 data error.	Same as section 13
	10	● ○ ○ ○	Head 7 data error.	Same as section 13
	7	○ ● ● ●	Head 6 data error.	Same as section 13
	6	○ ● ● ○	Head 5 data error.	Same as section 13
	5	○ ● ○ ●	Head 4 data error.	Same as section 13
	4	○ ● ○ ○	Head 3 data error.	Same as section 13
	3	○ ○ ● ●	Head 2 data error.	Same as section 13
	2	○ ○ ● ○	Head 1 data error.	Same as section 13
	1	○ ○ ○ ●	Head 0 data error.	PCA-A1*, disc cartridge, PCA-A6, PCA-A5
○ = LED "OFF"      ● = LED "ON"				* Most probable source